Wallowa-Whitman National Forest
Fisheries Habitat Improvement
FY 1991 Annual Report

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GRANDE RONDE RIVER SUBBASIN

UPPER NORTH FORK JOHN DAY RIVER SUBBASIN

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INTRODUCTION

This report describes fisheries habitat improvement accomplishments on the Wallowa-Whitman National Forest (NF) during FY 1991 (April 1, 1991 - March 31, 1992). This multi-year, multi-phase fish habitat improvement effort which began in 1984, is funded under the amended (1987) Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, Measure 703(c)(l), Action Item 4.2. Principal program funding is being provided by the Bonneville Power Administration (BPA).

The overall Forest fisheries program goal is to optimize anadromous spawning and rearing habitat conditions for juvenile and adult chinook salmon and steelhead trout, thereby maximizing Smolt production as a mitigation measure for fishery losses due to the mainstem Columbia River hydroelectric system. Specific goals and objectives of this fisheries habitat improvement program are detailed in the Wallowa-Whitman National Forest Habitat Improvement Plan (Uberuaga 1988).

Project activities are located on four Ranger Districts (RD) within the Wallowa-Whitman National Forest. The Baker and Unity RD administer the upper headwater portions of the North Fork of the John Day River. The Umatilla National Forest (NF) administers the remaining downstream sections on NF lands. The LaGrande, Wallowa Valley, and Eagle Cap RD's and Hells Canyon NRA administer streams on NF lands within the Grande Ronde River subbasin; the LaGrande RD being responsible for the Upper Grande Ronde and the other units the Lower Grande Ronde and tributaries.

Proiect Subbasin Descriptions

The Grande Ronde River subbasin is comprised of a drainage area of approximately 4,070 square miles which includes such major streams as Joseph Creek, Catherine Creek, the Upper Grande Ronde, Wenaha, Wallowa, Lostine, and Minam Rivers, as well as a few smaller tributaries (Oregon Department of Fish and Wildlife 1986). The Upper Grande Ronde Drainage, approximately 1,622 square miles, is located above the confluence of the Grande Ronde and Wallowa Rivers. There are currently four ongoing improvement projects on NF lands within this basin (Figure 1). The Joseph Creek drainage, a major drainage within the Lower Grande Ronde River, drains approximately 556 square miles and contains four major ongoing projects (Figure 2). While these upstream areas are all on NF lands, those lands below the headwaters lie primarily in private ownership. Streamflow patterns in the Grande Ronde exhibit typical spring floods common to northeast Oregon streams with minimum flows usually occurring in August or September.

The North Fork of the John Day River originates on the northeast slopes of Columbia Hill, a peak of the Elkhorn Mountain Range within the North Fork John Day Wilderness. After three miles, the stream leaves wilderness at Peavy Cabin, a local landmark, and re-enters the wilderness near the North Fork John Day Campground, approximately seven miles of non-wilderness stream. The North Fork of the John Day River is under part of the National Wild and Scenic Rivers System and is an anadromous fish emphasis area under the Forest Plan. The river and its tributaries provide over 40 stream miles of salmon and steelhead habitat.

Anadromous fish contend with the lower three Columbia River dams with regard to upstream and downstream passage.

Fisheries Resources

The Grande Ronde River subbasin supports both natural and hatchery runs of spring chinook salmon and steelhead trout. Natural rainbow trout and bull trout are also produced. Sockeye salmon and coho salmon runs are now extinct in the basin. Chinook salmon juveniles which are used for supplementation of natural stocks are currently being produced at Looking Glass Hatchery. A chinook and steelhead adult trapping and juvenile outplanting facility was recently constructed (1987) at the confluence of Deer Creek (Big Canyon) and the Wallowa River. The Joseph Creek subbasin is strictly managed for wild steelhead production. Current steelhead production potential for the Grande Ronde Basin is estimated at 16,566 adults and 432,844 smolts (Oregon Department of Fish and Wildlife 1986). However, actual production is estimated to be near 10-20 percent of potential due to mainstem passage problems for juveniles and adults.

The John Day River subbasin supports the largest remaining, exclusively wild runs of spring chinook and summer steelhead in Northeast Oregon, the North Fork of the John Day River being the most important anadromous producer in the subbasin.

FIGURE 1
JOHN DAY BASIN
USFS-BPA PROJECT LOCATOR MAP

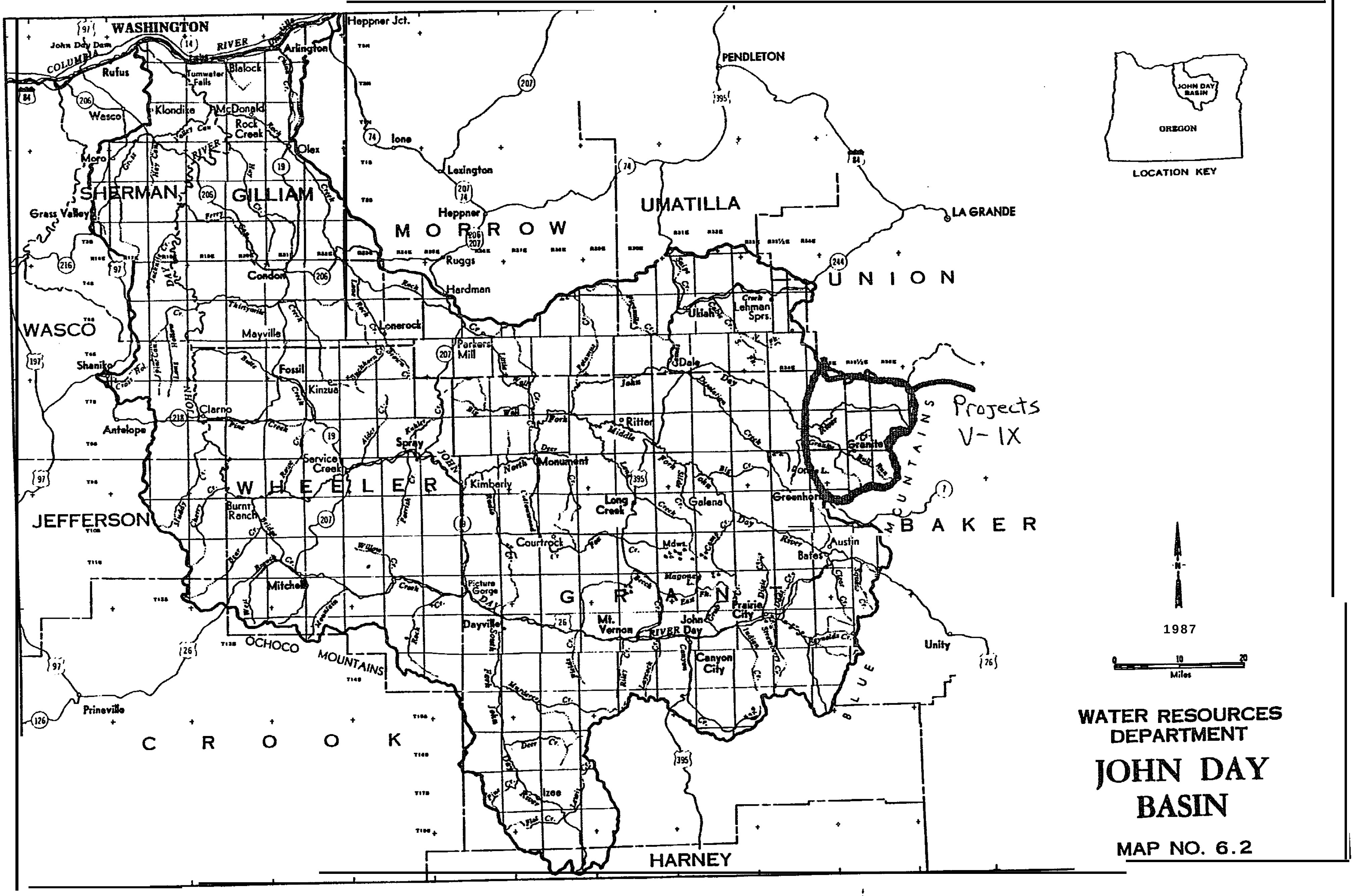


FIGURE 2
GRANDE RONDE BASIN
USFS-BPA PROJECT LOCATOR MAP

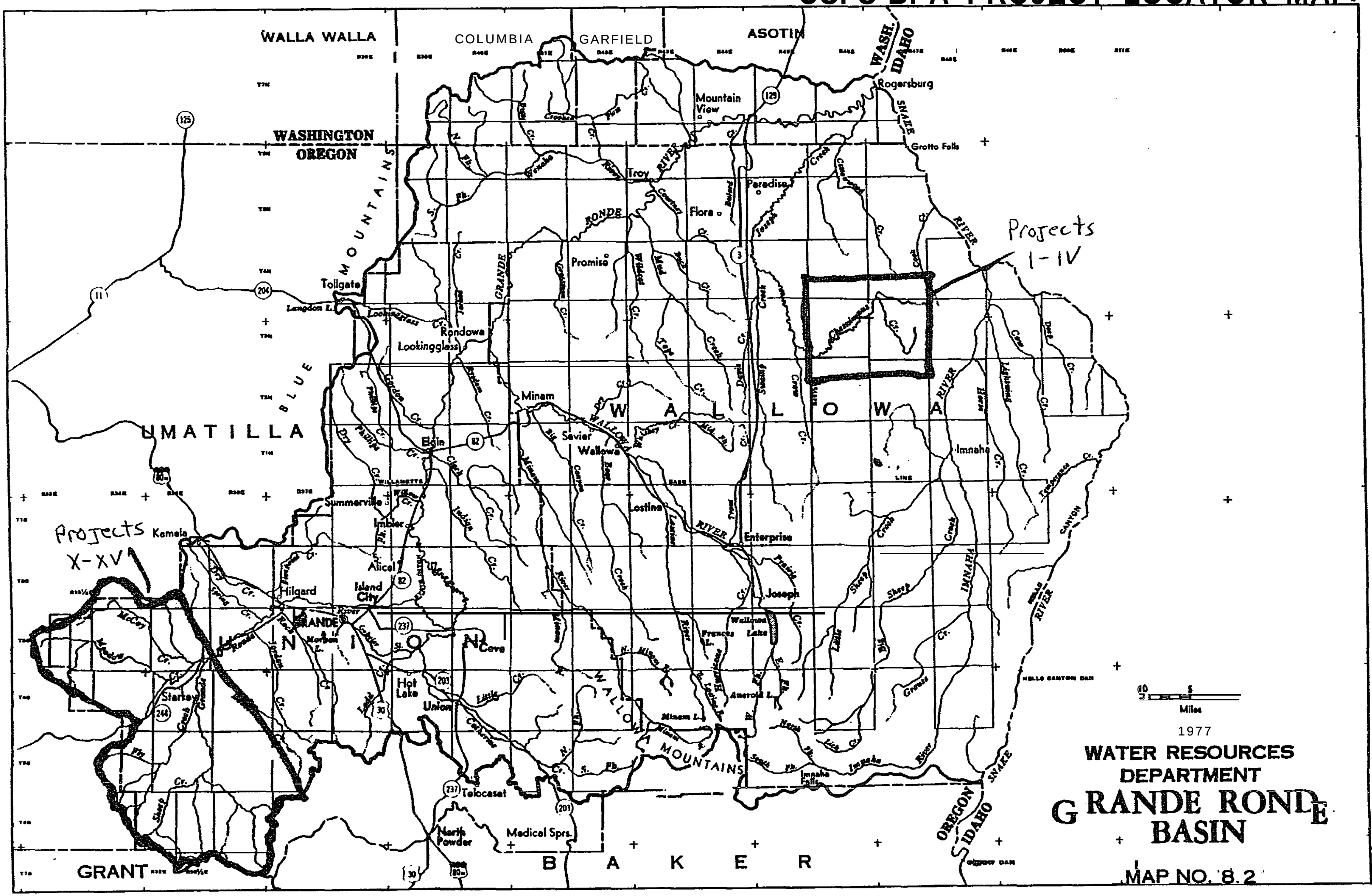
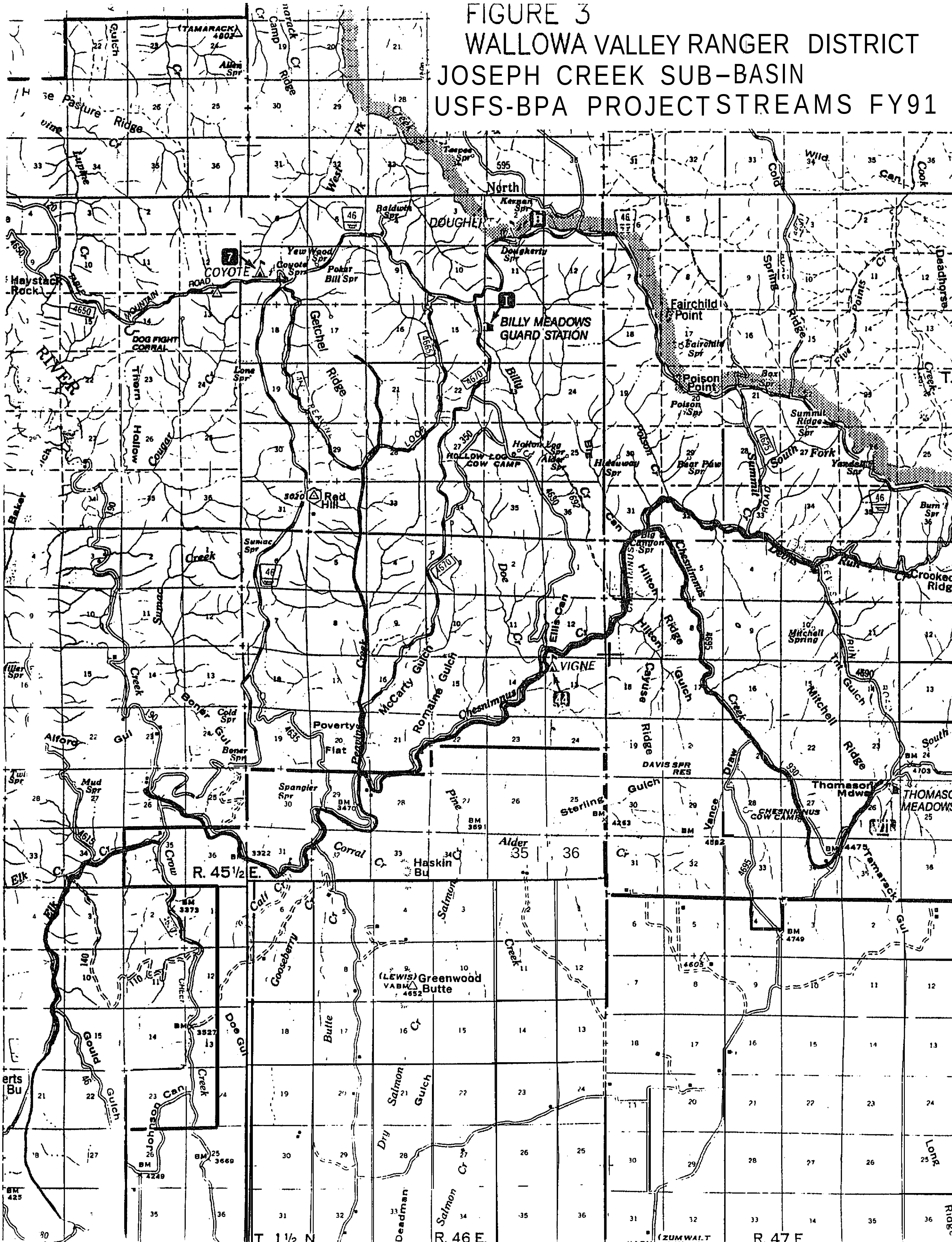


FIGURE 3

WALLOWA VALLEY RANGER DISTRICT

JOSEPH CREEK SUB-BASIN

USFS-BPA PROJECT STREAMS FY91



. Limiting Factors

Historic patterns of land use in northeast Oregon have left most riparian areas in a far less productive state than their natural potential. Placer mining in the late 1800's left many streams with little or no shade, large sediment loads, and radically disturbed channels. Inadequate control of past activities such as logging, roading, and grazing left managers with degraded habitats in most cases. Farming and irrigation of cropland in the lower portions of the basins has also significantly added to habitat loss. Symptomatic of these conditions are wide, shallow streams with low summer flows and high water temperatures, channels with low diversity, and typically without adequate amounts of instream debris.

Limiting factors associated with instream and riparian habitat degradation were identified by the Oregon Department of Fish and Wildlife, USDA-FS, and Confederated Tribes of the Umatilla Reservation (James 1984). These factors are:

1. High summer water temperature - Loss of riparian vegetation and low summer flows result in water temperatures in excess of 80 degrees fahrenheit. High temperatures limit available summer smolt rearing habitat and make the cooler upstream tributaries relatively more important to salmonid production.

2. Low summer flows - Irrigation withdrawals result in extremely low flows in the Grande Ronde River. Poor watershed management practices further aggravate flow conditions, resulting in many intermittent streams which were once perennial.

3. Lack of riparian vegetation - Riparian vegetation loss, principally from ungulate overgrazing, results in many undesirable conditions. Essential fish habitat is lost along with the riparian area's ability to dampen flood peaks and increase groundwater recharge. Channels become unstable and readily erode, concentrating flows and accelerating downcutting.

4. Lack of habitat diversity - Low habitat diversity, is caused principally from the absence of large, woody debris in and along stream channels. Wood plays a critical role in maintaining stream structure and fisheries production. Past activities such as instream debris cleaning programs, have left many streams without this critical component.

5. Lack of Channel Stability - Low channel stability results from many causes: overgrazing, improper timber harvest methods, instream timber salvage, mining operations, etc. Streams, once narrow and deep, widen out and become shallower, becoming more prone to creating new channels and down cutting. Research data released in 1991 indicates a major loss of pool habitat in the Upper Grande Ronde River except of those areas rehabilitated by the BPA/USFS habitat projects (Sedell and Everest 1991).

METHODS AND MATERIALS

FY 91 FS fisheries improvement implementation projects were performed by FS fish, wildlife, and range personnel using service type contracts for equipment use and project construction.

Riparian Vegetation Restoration

Fencing - Fencing to control ungulate use along riparian zones is a primary management approach used to protect and rehabilitate habitats. Two commonly used methods are riparian pasture fencing and riparian exclosure fencing. Pasture fencing usually encloses a wide section of riparian zone, allowing for future carefully controlled grazing. Riparian exclosure fencing results in permanent, narrow exclosures along riparian zones with no future grazing. Several streamside management unit fencing techniques are considered, i.e., conventional barbed-wire, smooth-wire New Zealand, and buck and pole.

Streamside Plantings - Streamside vegetation plantings were integrated with other rehabilitation measures to provide riparian shade and cover. This is needed to reduce water temperatures, stabilize streambanks, and supplement the release of existing natural vegetation. To ensure success and provide protection of this investment, supplemental plantings usually occurred within fenced riparian pastures or exclosures. Species most commonly planted were willow, cottonwood, alder, dogwood, and hawthorne. Plantings are made from small scions (12-16"), larger pole cuttings (3-6'), potted nursery stock from seedlings, and rooted stock from cuttings. Planting is done either by hand, auger or backhoe depending on site conditions. Planting procedures usually include scalping, excavation to the water table, mulching and fertilization.

Habitat Diversity Improvement

Adding habitat diversity to a. stream channel may occur in many ways and usually results in an improvement of pool area, pool quality, spawning gravel and cover, all parameters characteristic of good habitat. The types of instream structure used include: log weirs/berms in a variety of configurations; whole tree additions with and without rootwads; rock sills/ berms; rock clusters and deflectors, riprap. Both "hard" structures such as rock and log sills or weirs and "soft" structures such as whole tree additions or boulder placement were constructed. First, the sources of large woody material were identified and individual trees marked for felling. When abundant and not contributing to stream shading, trees were taken from within or near riparian zones. Soft structure additions were added at various angles, usually parallel to shore in order to maximize edge habitat. When possible, leaning trees next to the stream with attached rootwads were pushed over by the backhoe. Whole trees were cabled to their stumps or nearby debris with 3/8" galvanized cable; cabled and revetted into banks; cabled and deadmanned into banks; anchored by piling large boulders on top of the tree trunk; and left uncabled when approximately two-thirds of the tree length was above high water.

Planning, Inventorying, and Monitoring

Planning, inventory, and monitoring activities were conducted on NF lands in FY 91 in addition to habitat restoration. Each of these activities are ongoing in nature and continue to be refined.

RESULTS

Fisheries habitat improvement accomplishments during Fiscal Year 1991 occurred in four major work activities:

(1) Project monitoring, evaluation and reporting.
(2) Maintenance of previous projects.
(3) Streamside vegetation plantings.
(4) Implementation of habitat rehabilitation projects.

The following discussion presents the current status of each active project along with FY 91 accomplishments.

WALLOWA VALLEY RANGER DISTRICT

PROJECT I - CHESNIMNUS CREEK (Section G-H-I)

Chesnimnus Creek is tributary to Joseph Creek at the confluence with Crow Creek. The drainage area is approximately 190 square miles, 108 square miles are located on National Forest lands. Chesnimnus Creek contains a total of 16 miles of rearing and spawning habitat, 12 miles of which are located on National Forest lands. Sections G-H-I, from Vance Draw to the Thomason Guard Station, combine for a total of 4.6 miles of stream course, (Section G - 1.5 miles, H - 1.9 miles, I - 1.2 miles), 3.0 miles of Forest Service ownership and 1.6 miles of private ownership. These sections are characterized by a gradient that is very shallow throughout as the canyon turns out to rolling low hills, bluegrass meadows, and lodgepole pine overstory, the area is located within the Chesnimnus Grazing allotment.

These sections were inventoried by Forest Service personnel during the field season of FY 91 using the Hankin-Reeves procedure.

Watershed uses and impacts include reading, logging, livestock grazing, and farming. Numerous reaches on both NF and private ground have been channelized to accommodate road construction and hay field development. The factors limiting Steelhead production are rearing and spawning habitat. Five primary factors have been identified which affect the quality and/or quantity of rearing habitat. These factors are: 1) high summer water temperatures, 2) low summer flows, 3) lack of riparian vegetation, 4) lack of habitat diversity, and 5) poor channel stability. To compensate for these limiting factors intensive habitat improvement work has been implemented on both private and public lands for the past several years. Accomplishments to date include construction of 17.3 miles of riparian protection fence exclosing 8.65 miles of stream course on National Forest lands. These exclosures are designed as 9 separate units allowing water gaps for grazing livestock. The first six exclosures were constructed in 1986. The remaining 3 constructed in 1991. These exclosure units have received numerous riparian revegetation efforts. Including the planting of Lodgepole and Ponderosa pine, native deciduous rooted species,and willow and cottonwood "poles". Instream habitat improvement structures placed include 101 "hard" structures (log weirs), and 129 "soft" structures which include whole trees, logs, boulders, and root wads. Construction of instream habitat improvement structures in Chesnimnus Creek was initiated in 1986 and continues to date.

FY 91 project accomplishments include construction of 185 instream habitat improvement structural complexes. This was the result of placing 321 components consisting of boulders, whole trees, logs, root wads, artificial log jams, or combinations of these. A major emphasis was placed on "soft" structures. The objective of structure design was to imitate naturally occurring large organic matter (LOM) and reproduce naturally occurring hydraulic processes. Historic uses of the riparian zones removed most if not all of the large woody debris that naturally would have accumulated in the stream channel, ie; deadfall, blowdown, etc.. Placement of "soft" structure provides the raw material for the natural hydraulic processes to form pools, glides, and riffles. While also providing fish cover and diversity of habitat. (see Appendix for locator map, and for Explanation and Summary sheets).

Equipment Used:

Backhoe - Case 580C	170.0 hrs at $35.50/hr =	$6,035.00
Loader - cat 931	150.0 hrs at $35.50/hr =	$5,325.00
Truck/Trailer	16.0 hrs at $35.50/hr =	$ 568.00
Dumpbox Trailer	39.0 hrs at $35.50;hr =	$1,384.50
		$13,312.50

FY 91 accomplishments also include the construction of approximately 4.0 miles of new riparian protection fence designed as 2 units exclosing 2.0 miles of stream course. The remaining 1.0 mile of stream course within Sections G-H-I will be protected with use of; 1) a silviculture plantation fence which incorporates the stream channel, and 2) a modified rotation grazing pasture which limits entry into the riparian zone to one day par grazing season.

These FY 91 accomplishments involved the preparation and administration of equipment rental, fence construction, and materials purchase contracts. Also involved was fence design and layout.

PROJECT II - STREAMSIDE VEGETATION PLANTING

In the spring of FY 91 Peavine Creek received A planting of 3,086 willow "poles" utilizing BPA funds. These plantings will provide critically needed stream shade. The collection was accomplished via Forest Service personnel. A backhoe and operator required for planting was secured via a equipment rental contract.

Equipment Used;

Backhoe · Case 580C	54.0 hrs at $35.50/hr =	$1,917.00
Truck/Trailer	4.0 hrs at $35.50;hr =	$ 142.00
		$2,059.00

To compliment the BPA funded willow "pole" planting, diversify the existing native vegetation, and provide parent material for future generations of riparian vegetation on Peavine Creek the USDA Forest Service funded a fall planting of 1,300 rooted deciduous species via a "Supply and Plant" contract. The species include;

Species	Quantity
Common Chokecherry (Prunus virginiana)	50
Dog Wood (Cornus stolonifera)	250
Willow (Salix bebiana, scouleri, lasiandra, ______	250
Black Cottonwood (Populus trichocarpa)	250
Alder (Alnus rhombifolia, tenuifolia, sinuata)	250
Hawthorne (Crataegus douglasii)	250
	1300

Also funded by the USDA Forest Service FY 91 was the planting of 1,800 conifers, including Ponderosa pine (Pinus Ponderosa) and Engelmann spruce (Picea engelmannii). These conifers were planted via Forest Service personnel in Chesnimnus Creek Section F.

Vegetation plantings in riparian areas, used in conjunction with other rehabilitation measures, prove effective in providing stream shade reducing streamwater temperatures, increasing bank stability, and providing a food source when leaves fall or insects fall off the leaves, essential components of good fish habitat. Portions of Chesnimnus Creek, Elk Creek, Peavine Creek and Devils Run Creek have been identified through habitat inventory es being deficient in stream shade and stabilizing streambank vegetation. This project is designed to correct that situation by continuing with ongoing, effective programs of planting deciduous trees, conifers, and by emphasizing the use of rooted native species in critical riparian areas.

The success of streamside riparian plantings is highly correlated to several factors, i.e., site selection, handling care, planting method, and species. Both spring and fall plantings are successful if proper care is taken. Since the onset of riparian planting in 1985 on the Wallow Valley Ranger District much has been learned about techniques for riparian revegetation. The keys for survival lie in the handling and storage of planting stock, and timing of planting. Conifers must be handled in the traditional method (kept cool and dormant) and planted in the spring. Rooted deciduous stock must be dormant at time of planting, and fall planting promotes development of root mass increasing survival. Willow and cottonwood "poles" (cuttings of willow and cottonwood into 8'-10' poles then planted in trenches excavated by backhoe at the channel edge) should be devoid of all leaves and lateral stems and stored wet till planted in the spring.

PROJECT III - ADMINISTRATION, MONITORING & REPORTING

This project consolidates all Wallowa Valley Ranger District monitoring, 8valuation, planning, and reporting.

A. Administration

1) Preperation of NEPA documents for project implementation
2) Presentation to Regional Field Review Team (R6) on accomplishments of Elk and Chesnimnus Creeks fisheries habitat improvement project
3) Preparation of BPA FY 92 Work Statement
4) Plan and coordinate out year implementation needs

B. Monitoring

1) Implementation of monitoring plan
2) Installation of instrumentation, and data retrieval and analyses of streamwater temperatures (both winter & summer)
3) Summarized stream morphology survey information for pre- and post-BPA projects. Data was used from 1965-66 and 1991
4) Installation of permanent stations and measurement of riparian canopy density. Re-measurement of stations also took place
5) Conducted riparian planting survival survey
6) Mapping of temperature and riparian canopy stations

C. Reporting

1) Preparation of Monthly reports on BPA activities and accomplishments
2) Preparation of BPA Annual Report
3) Mapping of all fisheries habitat improvement measures (e.g. I instream structures, fencing)

Monitoring variables included streamwater temperature, stream morphology, and riparian vegetation. These variables have been identified as limiting factors for salmonid populations. The objectives of the monitoring program is (1) to establish baseline information and (2) to evaluate the effectiveness of BPA stream rehabilitation efforts. This section will describe the monitoring projects conducted during fiscal year 1991. Funding for monitoring projects was sponsored by both BPA and USDA Forest Service.

A. Stream Temperature

Streamwater temperatures were recorded every hour during the summer months for Chesnimnus Creek (Section G), Davis Creek, and Elk Creek (Exclosures #7-11). Additionally, streamwater temperature was recorded every 2 hours during the winter months on Elk Creek. Monthly maximum and minimum temperatures were determined from this data. Temperature stations were located above and below BPA project areas (see Figures for maps). Data was collected with Ryan TempMentors and Ryan thermographs.

Figure 8. shows the maximum streamwater temperatures for Chesnimnus Creek (Section G). This section received BPA rehabilitation work (woody debris input) during July 1991. The section is approximately 1.3 mile long. The data collected this year was to determine baseline summer streamwater temperatures. Both the above and below temperature stations recorded hot temperatures during June and July (70-77 degrees F). The below project area temperature station recorded 55 days during June thru September that maximum temperatures were 68 degrees F or greater.

Figure 8. indicates a heating trend thru this section (approximately 4 degrees F) at least for the months of June and July. This trend probably would exist for August and September (it may be a degree or two higher based on temperature measurements on other sections of Chesnimnus Creek) but could not be assessed since the station above the project area dried up in mid-July. This section of Chesnimnus Creek has poor water quality for salmonid populations.

The Davis Creek BPA project area is approximately 2.0 miles long. A fence exclosure was completed in 1989. In-stream work is scheduled for FY92. Summer steamwater temperatures that were collected will provide a baseline to help determine the effectiveness of this project.

Figure 9. shows a cooling effect thru the BPA project area of 3-5 degrees F for May, June, and July. Maximum streamwater temperatures below the project area stayed below 68 degrees F up to July 12, 1991. After this date the stream dried up. The temperature station above the project area had maximum temperatures of 70-73 degrees F for June, July, and August. This station had 32 days where the streamwater temperatures were 68 degrees or greater. This station also dried up, but it occurred later in the season (August 13, 1991). Previous surveys conducted by Oregon Dept. of Fish and Wildlife (ODF&W, 1966) for this section of Davis Creek also indicated parts of this reach being dry in July.

Davis Creek within the BPA project area provides an important cooling reach for the Swamp Creek basin. The mouth of Swamp Creek currently has high streamwater temperatures (>68 degrees F). This section of Davis Creek, however, provides limited summer salmonid habitat due to high water temperatures and low water quantities during the summer. This section may have the potential to run water all summer long and provide dense riparian vegetation since it runs thru a low gradient meadow-like valley. The current monitoring projects will help determine if this potential can be achieved.

The fence exclosures on Elk Creek (#7-11) are approximately 7 years old. The reach of stream monitored was 1.2 miles long. Figure 10. illustrates a cooling trend from the upstream exclosure (#7) to the downstream exclosure (#ll) of 3-5 degrees F. This was also documented during FY91. During 1983 streamwater temperatures stayed constant thru the reach. Water quality is improving. Reduction of water temperatures appears to be directly connected to BPA project work rather than a meteorological change (i.e., wetter conditions; more water available in watershed for cooling). Summer flows for rivers in nearby basins were lower in 1991 and 1991 than 1983 (20-40% lower depending on the month). The Elk Creek project indicates that with riparian plantings and livestock fence exclosures it takes 7-8 years before decreases in water temperature can be expected.

Streamwater temperatures, however, still remain high for Elk Creek; the temperature stations above and below this section recorded maximum temperatures between 69-75 degrees F for July and August Additionally, the above station had 54 days of greater than 68 degrees F while the below station had 37 days. The Elk Creek project is helping reduce the already high temperatures flowing into the project area. Riparian shading has not reached its potential for Elk Creek so further reduction in stream temperature is expected in the future as the canopy grows.

Winter streamwater temperatures were measured in the same section of Elk Creek. January thru March had minimum temperatures of 32 degrees F. In April the ice began to melt; minimum temperatures of 34 degrees F were recorded in both the above and below temperature stations. No difference in winter monthly minimums between the above and below temperature stations were observed.

B. Stream Morphology

The Hankin and Reeves stream survey method (1988) was used to collect stream information. The information collected included: percentage of habitat types by surface area, average residual pool depth, large woody debris pieces/mile, and bankfull channel width/depth ratio. Such information indicates the morphology of the stream and therefore the suitability for salmonid populations. Moreover, these stream characteristics can be measured in subsequent years to help determine the effectiveness of BPA projects.

Three streams were surveyed during the summer of 1991. Surveys were conducted on Chesnimnus Creek (section I), Davis Creek, and TNT Gulch to establish baseline conditions prior to BPA implementation work. Figure 8. illustrates the distribution of habitat types by surface area and Figure 12. shows the number of pieces of large woody debris per mile for TNT Gulch, and Chesnimnus and Davis Creeks.

TNT Gulch had a high percentage of riffles (92%) and a low percentage of pools (3%). A survey conducted in 1966 by ODF&W showed 32% pools. Additionally, TNT Gulch is usually dry by August. The bankfull width/depth ratio is high (12) and indicates a wide and shallow channel. The amount of large woody debris was 12 pieces/mile.

Chesnimnus Creek had an even distribution of habitat types. There were 30% pools and 42% riffles in this section. ODF&W reported 75% pools in 1966. Average residual pool depth was 1.5 ft for this section. The bankfull width/depth ratio averaged 9. The amount of large woody debris was 18 pieces/mi.

Davis Creek was in the best condition of the streams surveyed this year. There were 55% pools with an average residual pool depth of 1.1 ft depth. ODF&W reported 70% pools in 1966. Average bankfull width/depth ratio was 7. The amount of large woody debris was 25 pieces/mile.

Based on ODF&W survey conducted 1966 the three streams surveyed this year have degraded since this time. Even though survey methods were different and an exact change can not be determined it is nevertheless fair to say a change has taken place in the negative direction (e.g., TNT Gulch 32% pools to 3%).Other stream characteristics measured, for example woody debris, were lower than other streams in this region. Furthermore, this survey indicates salmonid habitat is in poor condition; some type of stream rehabilitation work is needed.

C. Riparian Vegetation

Permanent transects were added to an already existing transect system on Elk Creek. The transects were installed to measure riparian canopy density (both tree and brush) which would be used to monitor riparian plantings and the effects of riparian livestock exclosure fences. To assess these more accuratley an additional 23 transects were installed (9 in areas which are not within fence exclosures, and 14 in areas with fence exclosures). These new transects and the already existing transects were mapped and the fence posts tagged with an identification tag for future measurements. Additionally, the history of the exclosure in regards to riparian plantings and riparian canopy density measurements were summarized. Re-meaurement of all transects and comparisons to previous measurements (1984,1988) is scheduled for 1992.

Permanent transects (a total of 41) were mapped and canopy density measured on Chesnimnus Creek sections E, F, and G. Riparian canopy density was measured at each transect according to Platts and others (1987). Average riparian canopy density for sections E, F, and G were 4%, 3%, and 9%, respectively. These are very low values for our region. The potential for these sections is much higher (probably between 30-40%).

Survival of 1991 riparian plantings were conducted on Devil's Run and Chesnimnus Creek (Sections E and F). Each stream received about 500 native plantings. Overall survival rates were between 70-80%. Survival depended on species and the location of planting.

Figure 13. shows the survival rates of different species for Chesnimnus Creek (Sections E and F). Willow (Salix spp.) and Dogwood (Cornus stolonifera) had lower survival rates than other species. Both these native species thrive in the Chesnimnus basin. These, however, had seem to be doing poorly and was related to the planting position. Most of these plantings were above the water table (e.g., on a 2 ft cut bank) rather than in the water table. Aspen (Populus tremuloides) and cottonwood (Populus trichocarpa) also seem to be struggling and this seemed related to the species rather than the position. these species are difficult to propagate/transplant. Alder (Alnus spp.), choke cherry (Prunus virginiana), rose (Rosa spp.), and currant (Ribes spp.) fared well after the first year (80-100 % survival). Rose was noted to be doing exceptionally well on unstable cutbanks; this species may have potential in stabilizing these areas.

PROJECT IV - PROJECT MAINTENANCE

This project consolidates all Wallowa Valley Ranger District maintenance of exclosure fences and instream habitat improvement structures.

A. Fencing

For FY 91 maintenance of a total of 33.6 miles of exclosure fencing (16.8 miles of stream) was accomplished. Maintenance was initiated prior to the start of the grazing season to repair damage occurring during the winter months (e.g., deadfall, blowdown). Maintenance continued through the grazing season at monthly intervals and as damage was reported during the physical monitoring phase or as reports of damage were received (e.g., tighten wire, mend broken wires).

STREAM NAME	FENCING		
	MILES OF	TYPE OF	STREAM EXCL.
CHESNIMNUS	17.3	4-STRAND BARBED	8.65
DEVILS RUN	4.00	4-STRAND BARBED	2.00
ELK	5.80	4-STRAND BARBED	2.91
PEAVINE	5.50	ELECTRIC	2.75
	1.00	5-STRAND BARBED	0.50

B. Instream Habitat Structure

Structural maintenance of instream habitat structures was identified during the physical monitoring phase of the maintenance activity. If desired results were not being achieved maintenance was performed. A higher than normal spring run-off (estimated 5-10 year flood event) required that 8 log weirs receive maintenance. Five log weirs on Chesnimnus Creek required anchoring gabions to be removed and stabilization of the log end with additional rip-rap. Three log weirs on Elk Creek required the re-laying of the apron. All maintenance required the use of a backhoe.

STREAM NAME	AMOUNT & TYPE REQUIRING MAINTENANCE
CHESNIMNUS SEG. A	5 LOG WEIRS
ELK	3 LOG WEIRS

In FY 91 additional USDA Forest Service funds were made available for the placement of "soft" structures in Chesnimnus Creek (Section F). With BPA funds supplied in 1987 25 log weirs were constructed in Section F providing water storage and pooling habitat.

Subsequent surveys revealed a lack of Large Organic Matter (LOM) and diversity of instream habitat. Whole trees, logs, boulders, were added to provide LOM and diversity of instream habitat, approximately 91 structural complexes were added.

Plant maintenance was also performed during FY 91 with USDA Forest Service provided funds. FY 91 saw the planting of 1,200 native deciduous rooted species utilizing BPA funds. Chesnimnus Creek, Section E, (1.35 miles divided equally into 2 exclosures) received 480 plants (40%) and Devils Run Creek (2.0 miles, 1 exclosure) received 720 plants (60%). Maintenance consisted of replacement of protective tree wraps, re-mulching, corrective pruning, and watering. This was done in an effort to give the plantings every chance of continued survival.

BAKER AND UNITY RANGER DISTRICT

PROJECT V - BEAVER CREEK

The objectives of 1991 were to produce a watershed analysis of Beaver Creek, in order to determine present condition and recommend a course of action to improve the watershed and aquatic ecosystem. Beaver Creek has previously been the subject of a BPA review, which included Platts, Elmore, and, Phillips. At that time fencing was discouraged as a course of action and rest from grazing was the prescription. An Allotment Management Plan had been completed for Beaver Creek in 1990, and we decided it would be prudent to see if implementation of the new AMP would lead to improvements in Beaver Meadows and the stream.

A stream survey conducted in May 1990 indicated fair to good width/depth ratio; fair to good % pool habitat in upper Beaver Creek; but poor W/D, bank stability, and % pool habitat in the lower sections of Beaver Creek. Preliminary analysis of aerial photos and of timber harvest activity from 1977 to present (old sales are still active in the watershed) indicate moderate to significant impacts from removal of forested cover from the watershed. The Wallowa-Whitman Peak Flow model was run in the late 1970's and some harvest units were modified as a result. The peak flow model will be run again in 1992, as Beaver Meadows is scheduled for project analysis in 1992. It is very unlikely that timber harvest will be allowed due to cumulative effects in the watershed.

Two permittees graze Beaver Meadows, which is one unit of the four unit, Camp Creek Allotment. In 1991 one of the permittees permits was vacated. This reduced the number of cattle on the allotment from 266 total to 166. Impacts to the banks of Beaver Creek were observed during the 1991 grazing season Temperatures are limiting in Beaver Creek, with temperatures running from 60 F to 66°F in mid-August. Beaver Creek is a steelhead stream, but the lower section where the stream is most degraded contains redside shiners.

Approximately one day of GS-11 funding and two days of GS-5 funding were spent in 1991 from the Beaver Creek budget. Due to limited personnel availabilty and time, no formal limiting analysis report was assembled. Unity Range personnel (one range conservationist for the entire district) did not analyize grazing trends in Beaver Meadows. Unity District will be looking at the entire Beaver subwatershed as part of the 1992 area analysis.

PROJECT VI - BOULDER CREEK

Whole trees with limbs and rootwads, ranging in size from 10" to 16", and boulders of native material were collected from upland areas and from the adjacent watershed to provide the material for rehabilitation of Boulder Creek.

The one mile portion of stream worked on during 1991 was severly impacted from previous mining operations. Due to channelization, movement of parent soil and rock, and dropping of the stream's elevation, side tributaries come in at the former floodplain level approxiamtely 6-8 ft above the present level of the main channel. At each of the two headcutting side tributaries 3 boulder sills were placed to help aggrade the stream and slow the headcut formation. In addition 5 rock weirs, and one log sill were constructed in the main channel to provide pool habitat. Three rock clusters, one log bundle, and two rock diagonals were also placed in the channel. Whole trees and additional insect killed lodgepole were scattered throughout the project area, both instream and on the floodplain ares. adjacent to the channel. Photos were also taken and the structures were mapped out.

Mining reclamation by the claim operator is scheduled for 1992 and consists of riparian shrub and hardwood planting. The extent of beaver activity was not recorded during 1991.

PROJECT VII - BULL RUN CREEK

The objective of the Bull Run project was to begin watershed monitoring of this chinook and steelhead system. The Wallowa-Whitman accomplished an updated Hankin and Reeves survey of eight stream miles in 1991. Grazing in the unit which includes Bull Run was delayed for resource concerns during 1991. In consultation with Ed Caleme of the Umatilla National Forest and Woody Hauter of the Wallowa-Whitman (Forest hydrologists), it was determined that the monitoring objectives were not clear enough to initiate the sediment and temperature monitoring. With advice from the forest hydrologists and district hydrologists a framework for monitoring has been discussed. Until the objectives are clarified and a plan developed the actual data collection will be postponed.

PROJECT VIII - TRAIL CREEK

Monitoring of the 1990 structures was completed. No additional cover logs were added in 1991. Water quality problems in the headwaters of South Trail Creek continue, as evidenced by turbid flow in the spring of 1991. The problem originates from historic mining activity. Until the water quality problems are addressed no further work will be planned for Trail Creek, except necessary maintenance of the 1990 structures. No maintenance was necessary in 1991.

PROJECT IX - MONITORING, ADMINISTRATION & REPORTING

A. Administration

- Prepared NEPA documentation and filed for required permits.
- Contract peperation and administration for project work was performed.

B. Monitoring

- Bull Run Creek: completed 7.9 miles of Hankin and Reeves stream survey.

- Granite Creek: completed 5.3 miles of Hankin and Reeves stream survey. Temperature readings include 46'F near Boulder Creek mouth 1400 6/13/91, 68°F one miles west of town of Granite 1500 7/22/91, 65°F west of W-W NF boundary 1530 7/22/91.

- Boulder Creek: 14 structure photo points, temp 52°F 1100 9/6/91, temp 67°F 1515 7/22/91, temp 44°F 1345 6/13/91.

- Beaver Creek: fish distribution/identification sampling on 7/15/91. Temperature readings; 65°F 1200 7/15/91 at confluence with Olive Creek, 64°F 1300 7/15/91 in lower meadow, 60°F 1400 mid-meadow, 66°F upper meadow (above culvert near 1970 road). Also 66°F 1400 8/19/91 above culvert near 1970 rd.

- Trail Creek: inventoried 1990 structures and updated map of structures. Took photos (structure and photo point).

C. Reporting

- Preparation of monthly reports on BPA activities and accomplishments.
- Preparation of BPA Annual Report.
- Preparation of NEPA documentation and acquiring required permits.
- Update and preparation of 1991-1995 implementation plan needs.
- Contract preparation and inspection reporting.

LAGRANDE RANGER DISTRICT

PROJECT X - MEADOW CREEK

Meadow Creek, a major subbasin of the Upper Grande Ronde River, lies within the Starkey Experimental Forest boundary. Meadow Creek and its riparian zone have a long history of impacts dating back to early logging activities. Grazing has further impacted the riparian community. Salmonid populations in Meadow Creek are composed of anadromous summer steelhead trout and resident rainbow trout. Historic Umatilla Indian tribal records document chinook salmon production in this stream. An extensive biological data base exists from aquatic research conducted since 1977.

The Meadow Creek project is a jointly funded BPA-FS improvement and evaluation project. The FS is responsible for funding all pre and post project improvement evaluations while BPA funds the planned implementation activities. The Pacific Northwest Research Station conducted both spring and fall out-migrant smolt sampling during FY 87. Their personnel also conducted a" analysis of large woody debris, comparing current conditions to those of a historical U.S. Fish and Wildlife Service inventory. During FY 87, the FS also contracted with Washington State University to conduct a complete hydrological analysis of the Meadow Creek drainage, including design and location of proposal improvement structures. A research design was prepared by PNW in 1988 which identifies evaluation objectives for 22,400 feet of stream.

Further analysis of pre-enhancement data (Everest and Boehne M.S.) revealed that the primary limiting factor was the lack of large pools with high quality cover. This indicated a need to revise the original work plan. Fred Everest and Jim Sedell from PNW research lab along with John Anderson (forest fish biologist) and district fisheries personnel developed a revised work plan which utilizes woody debris as the primary structure material. The detailed work plan is available on request and contains information on specific habitat improvement measures at different locations including structure objectives and construction design evaluations

FY 91 project accomplishments include the acquisition of New Zealand big game fencing wire, treated wood posts, and miscellaneous fencing materials for installation in FY91. Three separate riparian corridor big game fences were constructed. These exclosures were constructed within the F'Y 91 Meadow Creek project area.

PROJECT XI - <u>UPPER GRANDE RONDE RIVER</u>

The Upper Grande Ronde River (RM 194-212) drains an area of approximately 69 square miles. A FY 85 habitat inventory of the upper reaches identified approximately three miles of poor quality salmon and steelhead spawning/ rearing habitat, due primarily to past mining activities. A hydrological engineering evaluation in June 1987 provided the final design for structure placement. Specific project objectives were: (1) adult holding pool construction, (2) spawning gravel retention, and (3) increase juvenile habitat diversity. Implementation work commenced in N 87 on one mile of stream. Approximately one mile of additional mainstem stream was improved during FY 88 with a total addition of over 230 soft structures,and construction of 91 large pools. Specific details describing type and location of structures can be found in the FY 87 and FY 88 annual reports. Construction work has been confined to a narrow time frame between July 1 and August 15 due to the timing of spring chinook spawning activity. Construction has been accomplished with a personal services rental contract for a Model 201-C Hydra excavator with operator, a 580-C Case tractor and dump truck. Additional boulders and logs were stockpiled in N 88 for initiating construction on the last mile of stream. Instream structure work and bend repairs scheduled for FY 89 was deferred to FY91. Preparatory supplies and materials needed for the next mile of construction are stockpiled at the district.

FY 91 accomplishments include the placement of 120 logs and 510 boulders as instream hard structures in the final 1.5 miles of the Upper Grande Ronde River

Project. A model 2650 Linkbelt Tracked excavator and operator were contracted to complete this project.

PROJECT XII - FLY CREEK

Fly Creek, a significant tributary to the Upper Grade Ronde at river mile 184, has a drainage area of 52 square miles and a stream length of about 16 miles. The stream is characterized by two general reaches. The upper 8-mile reach of stream (Fly and Little Fly) lies on private land and is a low gradient, meandering meadow-dominated reach that has been impacted by livestock grazing.

The lower 7-mile reach lies on NF lands and is a low-moderate gradient stream coursing the first mile through a meadow bottom into a narrow valley. A 1985 habitat inventory identified a pool/riffle ratio of .2/.8 with low quality pools and little instream structure. Previous impacts include livestock grazing, reading and logging. Habitat objectives included increasing pool quality and quantity, diversifying instream habitat for rearing steelhead trout and increasing streambank stability. Approximately 250 instream structure additions occurred in FY 87, consisting of 56 hard structures (log weirs) and 194 soft structures (whole tree additions). Instream structure additions continued during FY 88 resulting in a total of 354 whole tree additions, 80 weirs, 5 boulder groups and 3 side channel excavations over the 7 mile reach. All structures were placed with a personal services rental contract for a backhoe and operator during June through September.

Considerable effort was also spent during FY 88 to close the Fly Creek road and its five stream crossings. Physical barriers were excavated at the top of the project above the first stream crossing and downstream at the Forest boundary. The closure was subsequently reinforced in FY 89 by district road maintenance crews to include ripping, seeding and cross drains. In FY 91 the road system was obliterated, seeded and fertilized to return the area to resource production.

FY 91 accomplishments include maintenance surveys of the project area as well as photo point monitoring.

PROJECT XIII - SHEEP CREEK

Sheep Creek is tributary to the Grade Ronde River at RM 197. The drainage area comprises approximately 58 square miles. Eleven miles of stream contain spawning and rearing habitat for chinook salmon. The upper two miles of stream lie on NF land and is characterized by a moderate gradient, narrow valley floor, which is heavily timbered. The middle three miles are characterized by a low gradient, meadow/timber complex with a. high degree of meander. The remaining six miles of stream are low gradient, meadow dominant, and lie on private land. Watershed uses and impacts include roading, logging, livestock grazing, and loss of lodgepole pine stands from insect epidemics.

Sheep Creek has received aquatic habitat improvements over a number of years. In 1980, a riparian pasture fence was constructed along one mile of stream, followed by the addition of 101 structures in 1985, creating 10,489 and 3,228 square feet of pool and cover areas, respectively.

In N 86, riparian pasture fencing was constructed along an additional 1.6 miles of stream.

A June 1987 habitat improvement project evaluation contract with hydrologist John Osborne, Washington State University, recommended digger log modifications and additional large woody debris placements along Sheep Creek. Twenty-seven structures were modified during FY 87.

Task accomplishment for 1988 included normal fence maintenance, photo point evaluation of structure effectiveness and planting of 3,000 3 year old Engelmann spruce trees, 2,000 deciduous cuttings and 3,000 deciduous nursery stock. Deciduous stock was comprised of native alder, hawthorne, willow, red-osier dogwood and black cottonwood. First year estimates of survival appear to be 80% for the spruce and 50% for the deciduous stock.

During FY 89 additional modification was done on the remaining digger logs. An additional 300 rooted deciduous stock (hawthorne and alder) were spot planted along 1500 ft. of stream. Second year estimates of survival appear to be leveling at 60% for spruce and 40% for the deciduous stock.

N 91 accomplishments include maintenance surveys of the project area including photo point monitoring.

PROJECT XIV · LIMBER JIM CREEK

Limber Jim Creek is a major tributary to the Upper Grade Ronde River. A N 89 habitat inventory identified the lower 2 miles of Limber Jim Creek as poor quality fish habitat. Limber Jim Creek from the North Fork Limber Jim Creek down to the confluence of the Grande Ronde River is characteristic of a meadow stream with low gradient, and was identified as having a low pool:riffle ratio with few deep pools. Surveys showed large woody debris lacking and stream shade poor. Historic watershed impacts and uses include roading, logging, mining, and livestock grazing. N 91 Habitat objectives included increasing pool quality and quanitity, providing stream cover, increasing bank stability, and diversifying instream habitat for spawning and rearing Summer Steelhead Trout, as well as rearing juvenile Spring Chinook Salmon.

During N 91 approximately 323 instream structures were placed in Limber Jim Creek. These structures consisted of 10 hard structures (log wiers) and 313 soft structures (whole tree additions and cover trees). Instream structure additions were placed during September and October with a Linkbelt model 2650 Trackhoe and operator utilizing a personal services contract.

PROJECT XV · MONITORING, ADMINISTRATION & REPORTING

A. Monitoring

- Read permanent photopoints on Sheep Creek.

- Structure effectiveness evaluation with random photo monitoring on Fly Creek and Upper Grade Ronde River.
- Sediment embeddedness sampling on the Upper Grande Ronde River.
- Establishment of 60 photopoints on Meadow Creek.
- Establishment of permanent photopoints on Limber Jim Creek.

Photo albums, structure evaluation documents and embeddedness data are available at the district upon request.

B. Administrative

- Review and comment on subbasin planning activity.
- Update and preparation of 1991 - 1995 implementation plan needs with projected budgets for active and new projects.
- Coordinating NEPA document changes and acquiring required permits.
- Coordination and evaluation of objectives for the Meadow Creek project design with PNW scientists.
- Field coordination of fence design and layout with PNW scientists.
- Coordination with engineers for access road development.
- Contract preparation and reporting activities were conducted.

C. Reporting

- Preparation of monthly reports on BPA project activities and accomplishments.
- Preparation of BPA annual report.
- Map preparation for all fisheries habitat improvement projects.

PROJECT XVI - PROJECT MAINTENANCE

All previously placed instream structures and riparian fencing areas were checked for maintenance needs and all necessary maintenance was completed. Maintenance consisted primarily of riparian corridor fencing repair and adjustment of soft structure configuration that was completed using hand equipment.

The flood event of May 19, 1991 dislodged log structures placed in Meadow Creek during N 91. The Large Woody debris remained in the project reach and was redistributed in the streambed creating improved and more diverse fish habitat. No maintenance was done.

The following table displays the projects monitored for maintenance needs in FY91.

STREAM NAME	FENCING TYPE	FENCING LENGTH	INSTREAM STRUCTURES TYPE	INSTREAM STRUCTURES MILES	INSTREAM STRUCTURES NUMBER
SHEEP CREEK	BARBED	1.6 MI.	HARD SOFT	3.0	101 0
FLY CREEK	SMOOTH	2.1 MI.	HARD SOFT	6.0	112 388
UPPER GRAND RONDE RIVER			HARD SOFT	2.0	95 330
MEADOW CREEK			HARD SOFT	3.7	115 291

FOREST HEADQUARTERS

PROJECT XVII - ADMINISTRATION

- Provided overall project guidance and supervision to Districts.
- Compiled project accomplishment reports, and performed budget accounting.
- Reviewed and provided comment on subbasin project planning activity.
- Assisted in the update and preparation of out-year implementation plan needs (projected budgets) for active and new projects.
- Field coordination with PNW scientists.
- Reporting activities consisted of preparation of monthly reports on BPA project activities and accomplishments, and preparation of BPA annual report.

SUMMARY AND CONCLUSIONS

Significant progress in stream habitat restoration continues to occur within the two project subbasins. The work accomplished in 1991 marks the end of the five year contract period for the Grande Ronde and John Day Projects. Work proposed in the FY91 project was accomplished in a timely manner and to professional standards.

A number of events occurred during the contract period that set a direction for the future of BPA-USFS cooperate project development. The concept of holistic watershed management, although always considered, has moved to the forefront of managerial thinking. Field reviews and managerial meetings between Forest Service and BPA administrators has resulted in agreements to use watershed wide management concepts in all future projects. Emphasis on watershed-wide plans by BPA, The Columbia Basin Anadromous Fish Policy of the Forest Service and the Forest Plan are promoting a new and progressive environment for stream rehabilitation projects.

The projects created through BPA funding have allowed the development of new stream technology and research. Research work partially funded by BPA at Meadow Creek is expected to be instrumental in furthering adaptive management course changes in stream rehabilitation on the Forest and in the Columbia Basin.

System and subbasin planning efforts are proving instrumental in reaching short term improvement goals and providing long-term direction. The Wallow-Whitman has acknowledged the abundant opportunities for habitat improvement and in less than two years has added expert fisheries staff to both the Forest and District levels. It is anticipated that project plans for N92 and into the future will be steadily expanding and improving.

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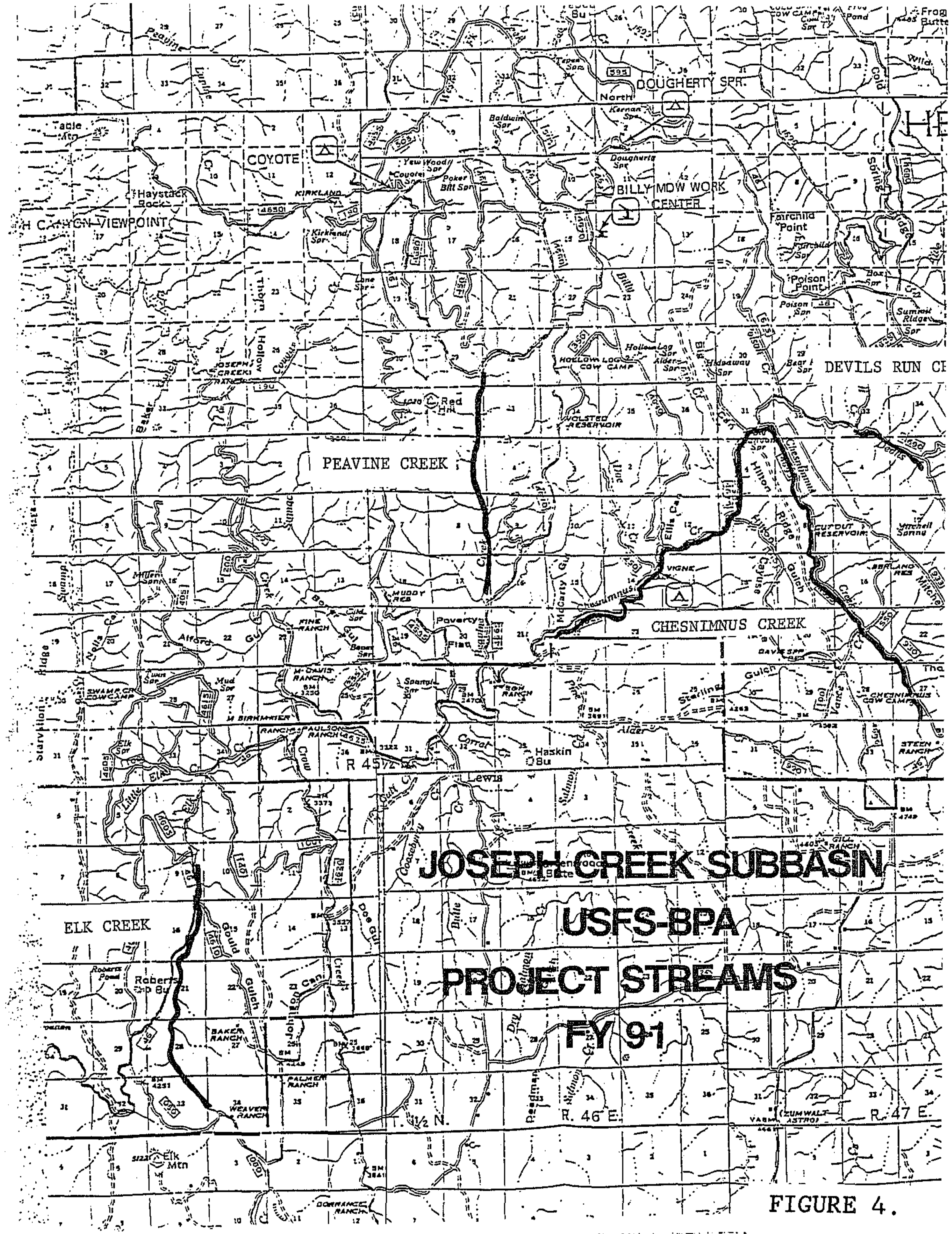
APPENDIX 1.



JOSEPH CREEK SUBBASIN
USFS-BPA
PROJECT STREAMS
FY 91
PEAVINE CREEK
CHESNIMNUS CREEK
DEVILS RUN
ELK CREEK
DOUGHERTY SPR.
COYOTE
BILLY MDW WORK CENTER
Haystack Rock
Table Mtn
Fairchild Point
Poison Point
Red Hill
Haskin Bu
Lewis
R. 46 E.
R. 47 E.
Elk Mtn

FIGURE 4.

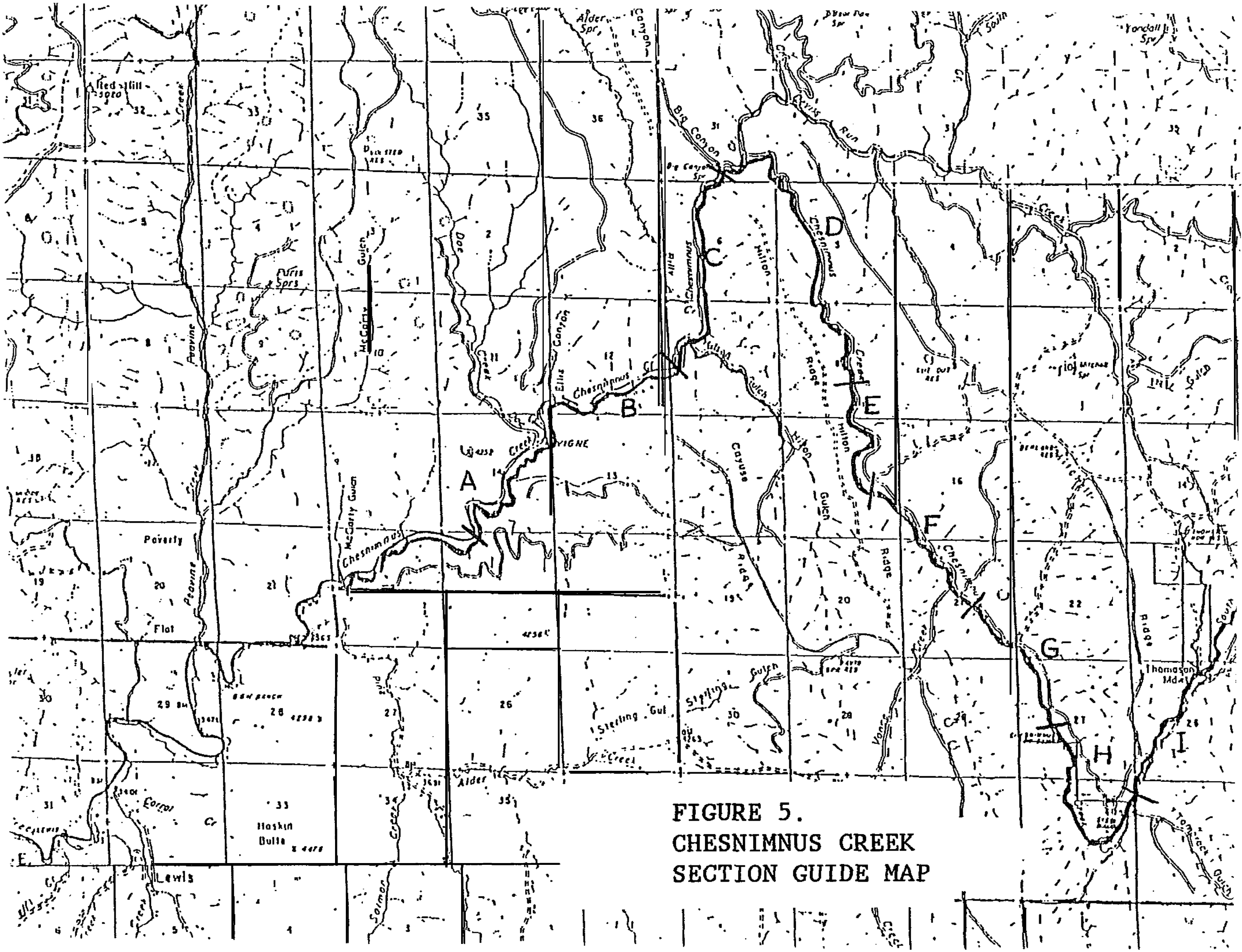
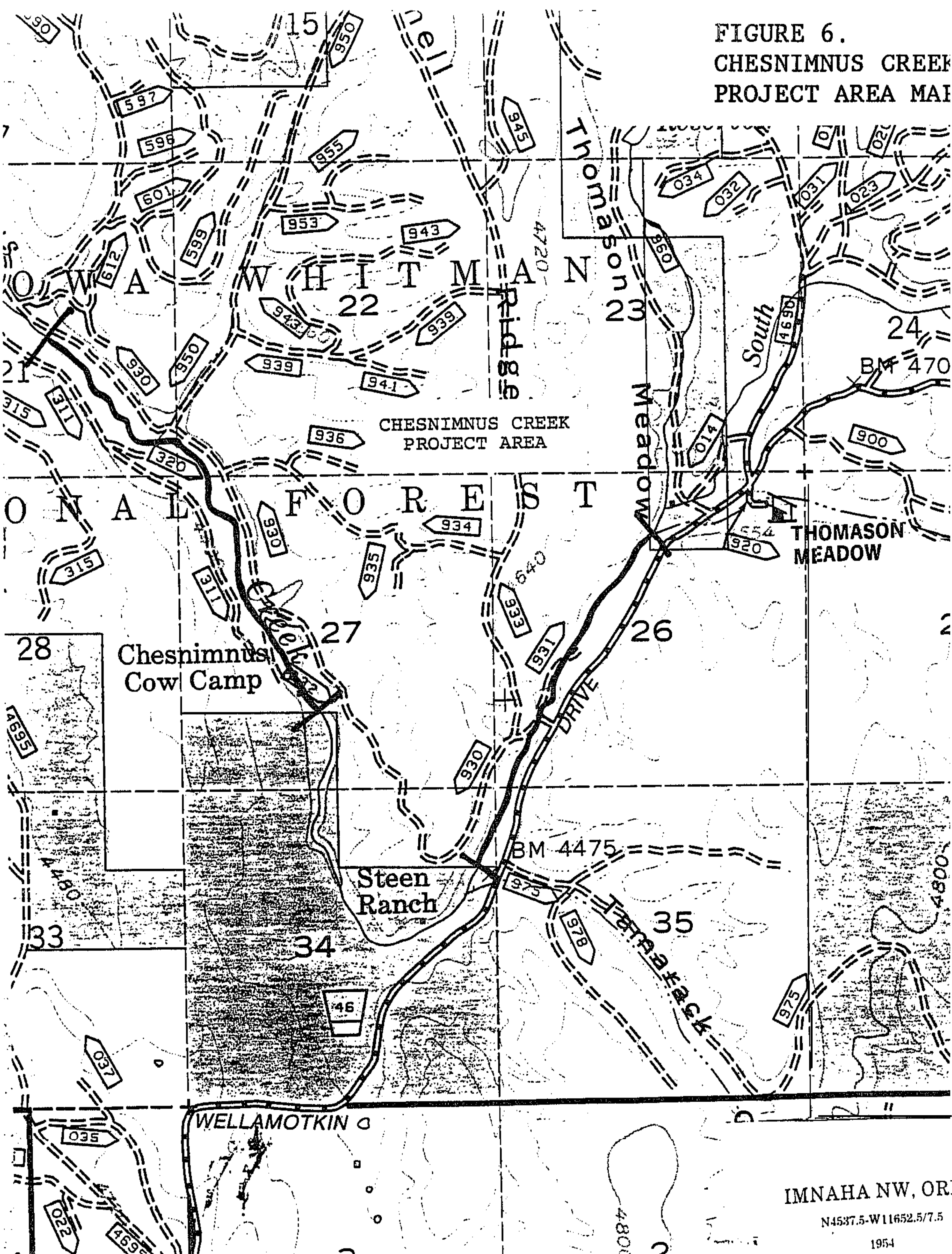


FIGURE 5.
CHESNIMNUS CREEK
SECTION GUIDE MAP

FIGURE 6.
CHESNIMNUS CREEK
PROJECT AREA MAP



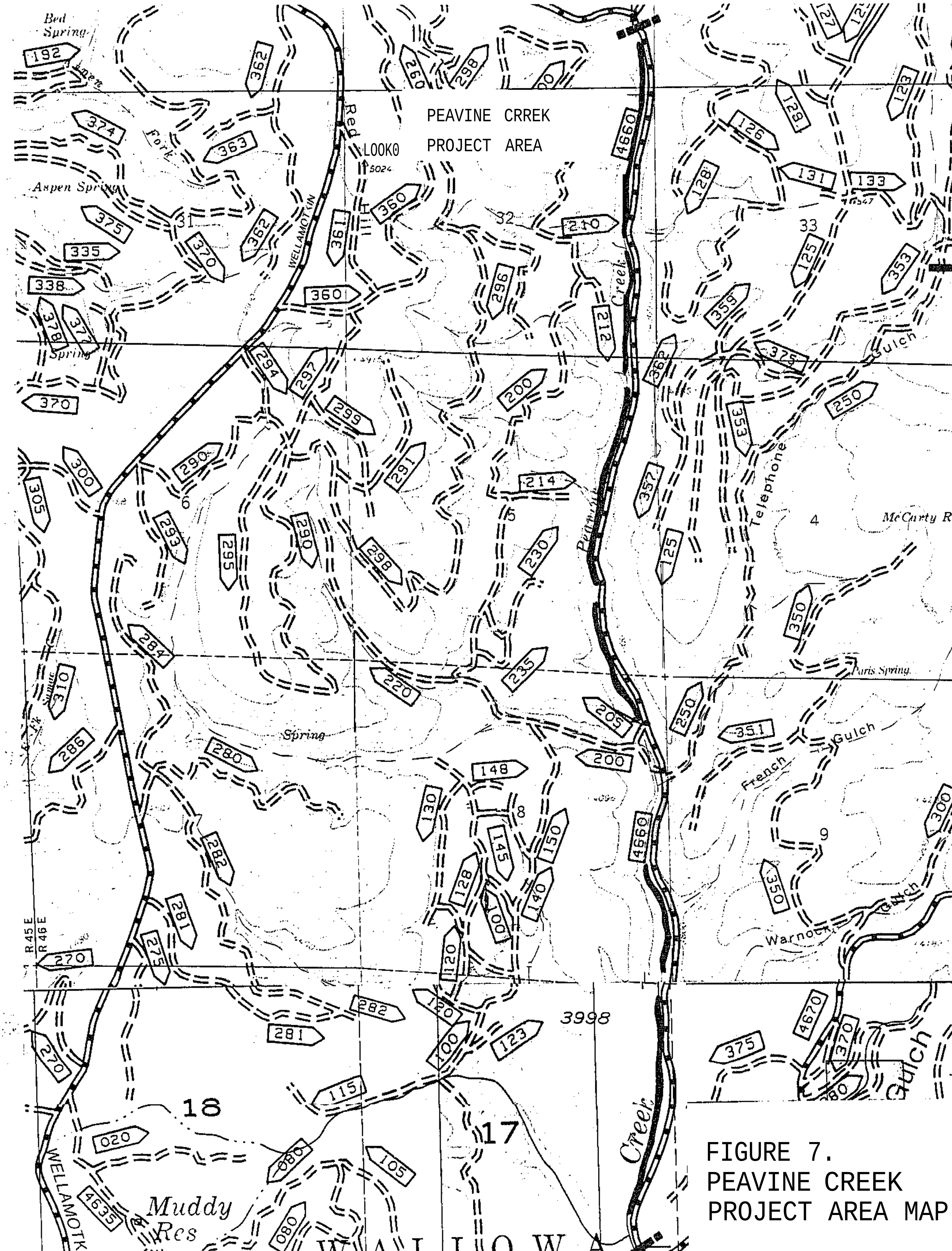


FIGURE 7.
PEAVINE CREEK
PROJECT AREA MAP

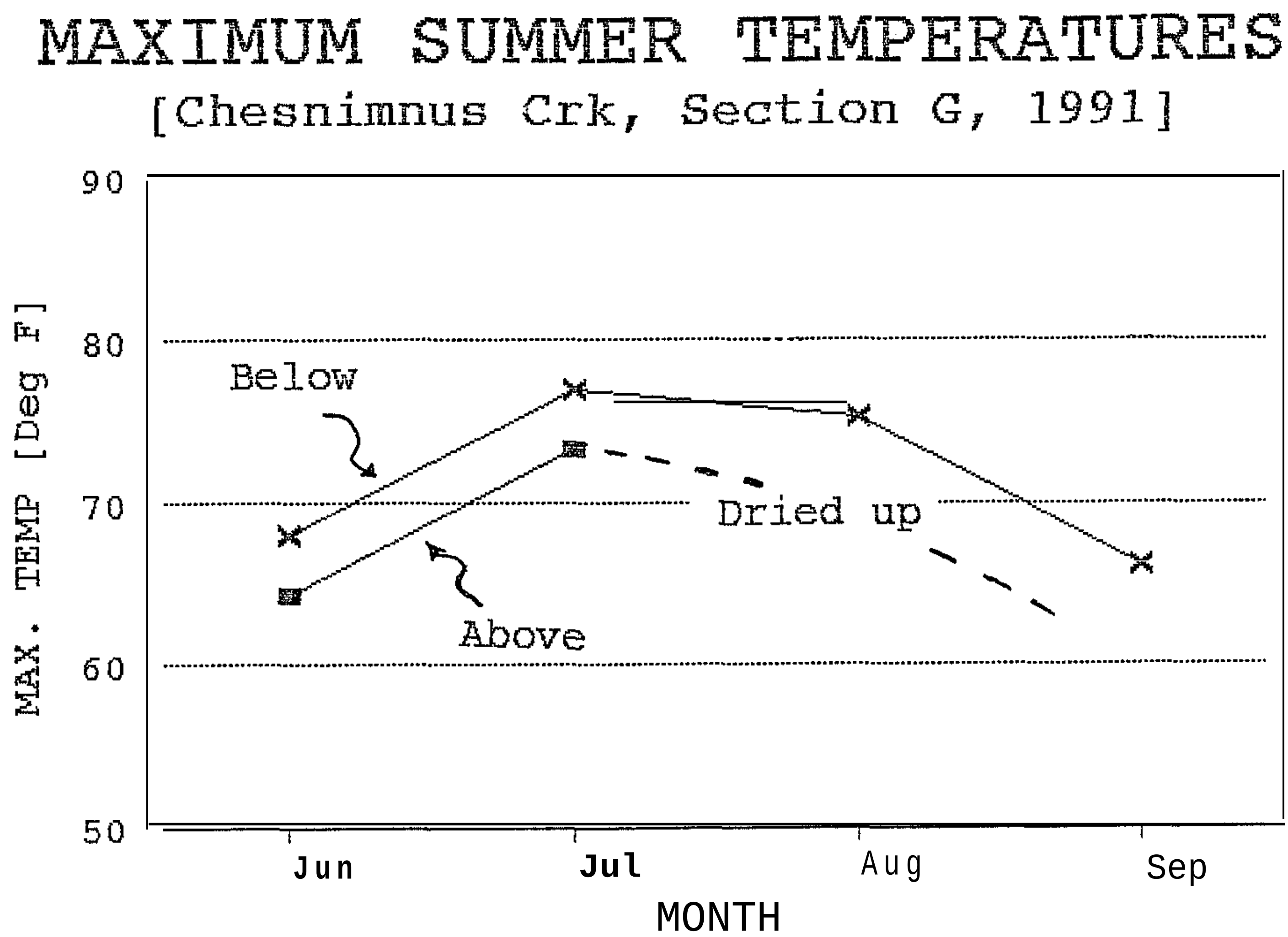


FIGURE 8. Monthly maximum summer streamwater temperatures above and below BPA project area for Chesnimnus Creek (Section G) during 1991.

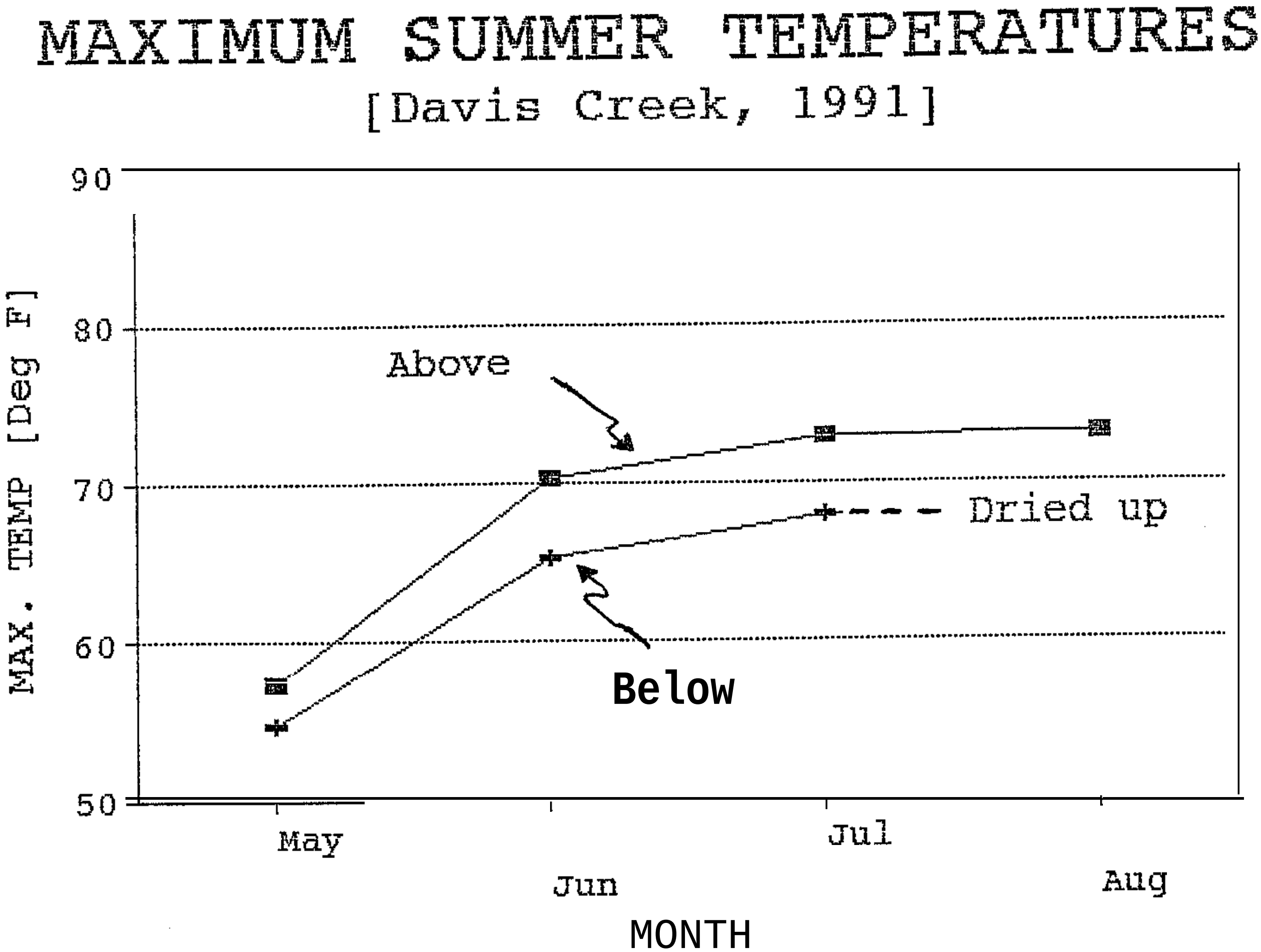


FIGURE 9. Monthly maximum summer streamwater temperatures above and below BPA project area for Davis Creek during 1991.

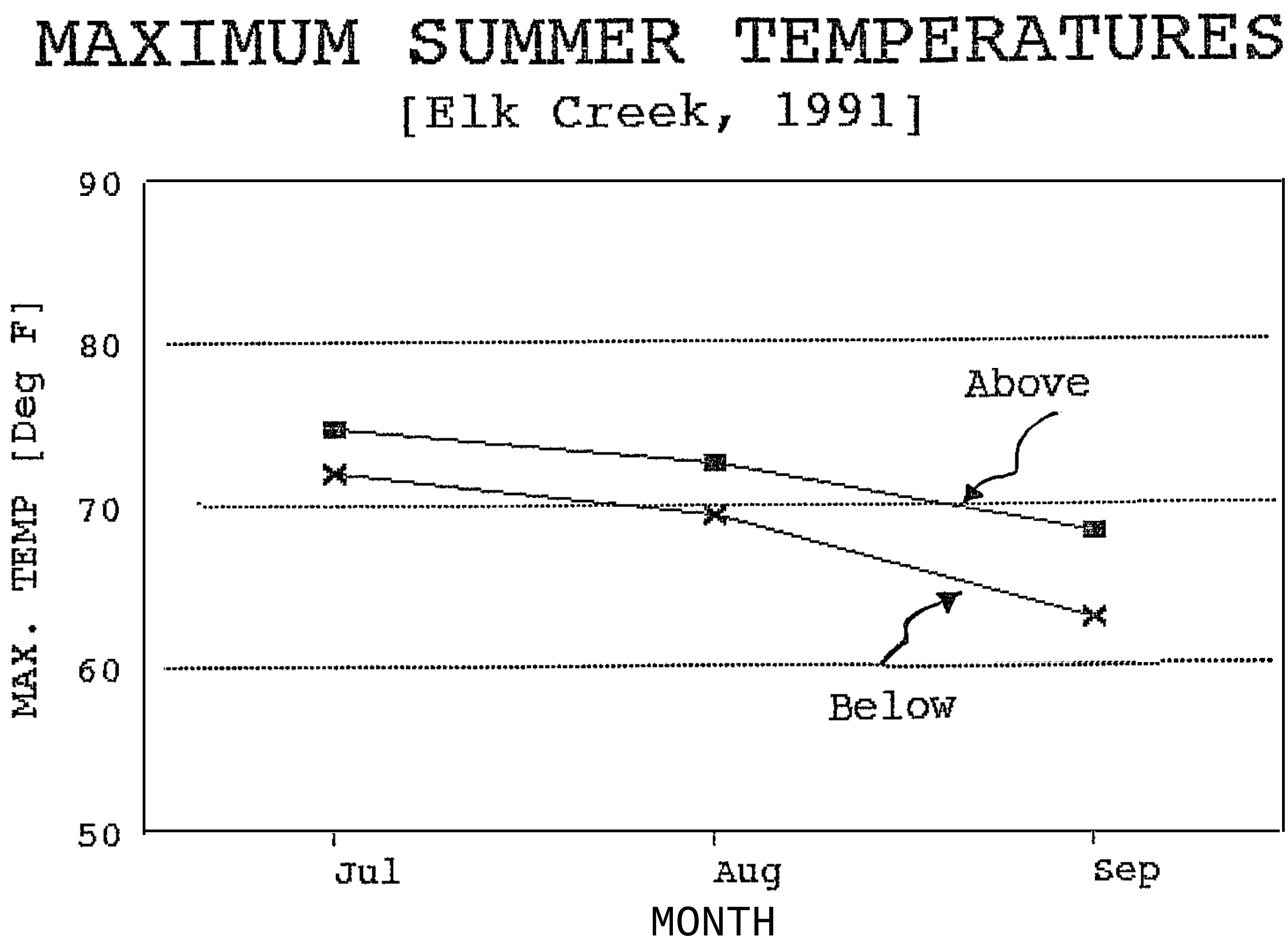


FIGURE 10. Monthly maximum summer streamwater temperatures above and below BPA project area for Elk Creek (fence exclosures 7-11) during 1991.

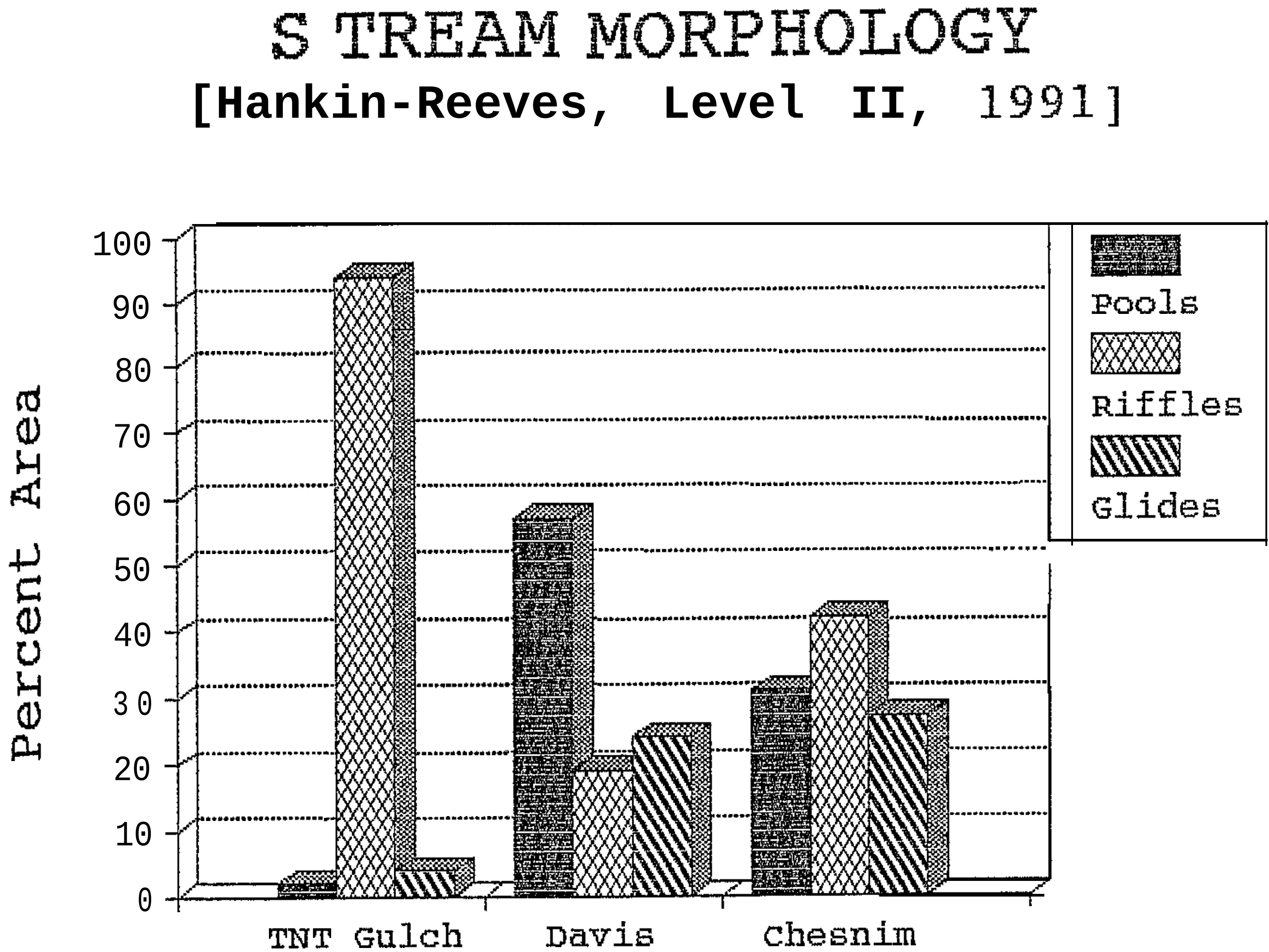


FIGURE 11. Stream morphology characteristics within BPA project areas for TNT Gulch, Davis Creek, and Chesnimnus Creek for 1991.

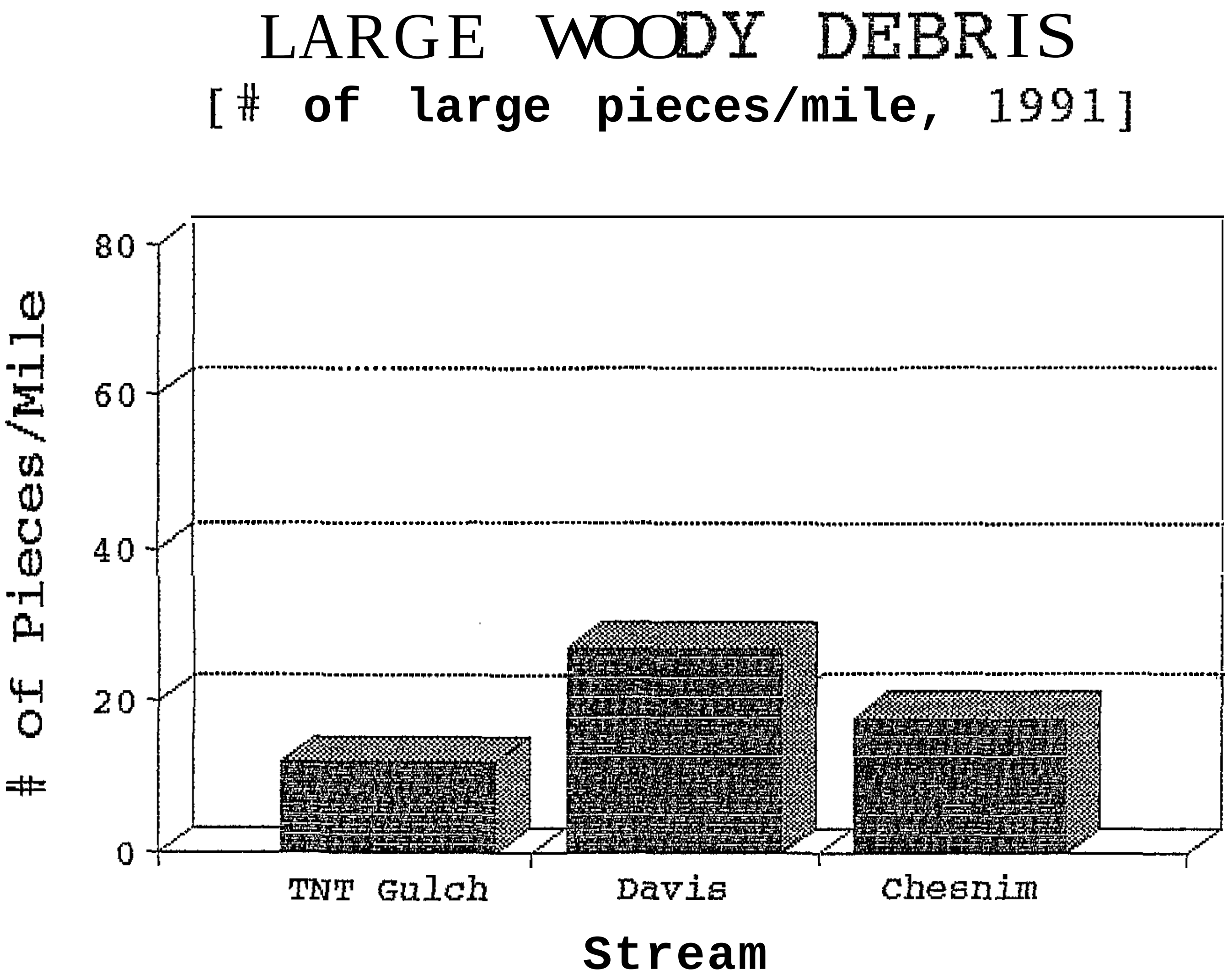


FIGURE 12. Number of large woody debris pieces per mile within BPA project areas for TNT Gulch, Davis Creek, and Chesnimnus Creek for 1991.

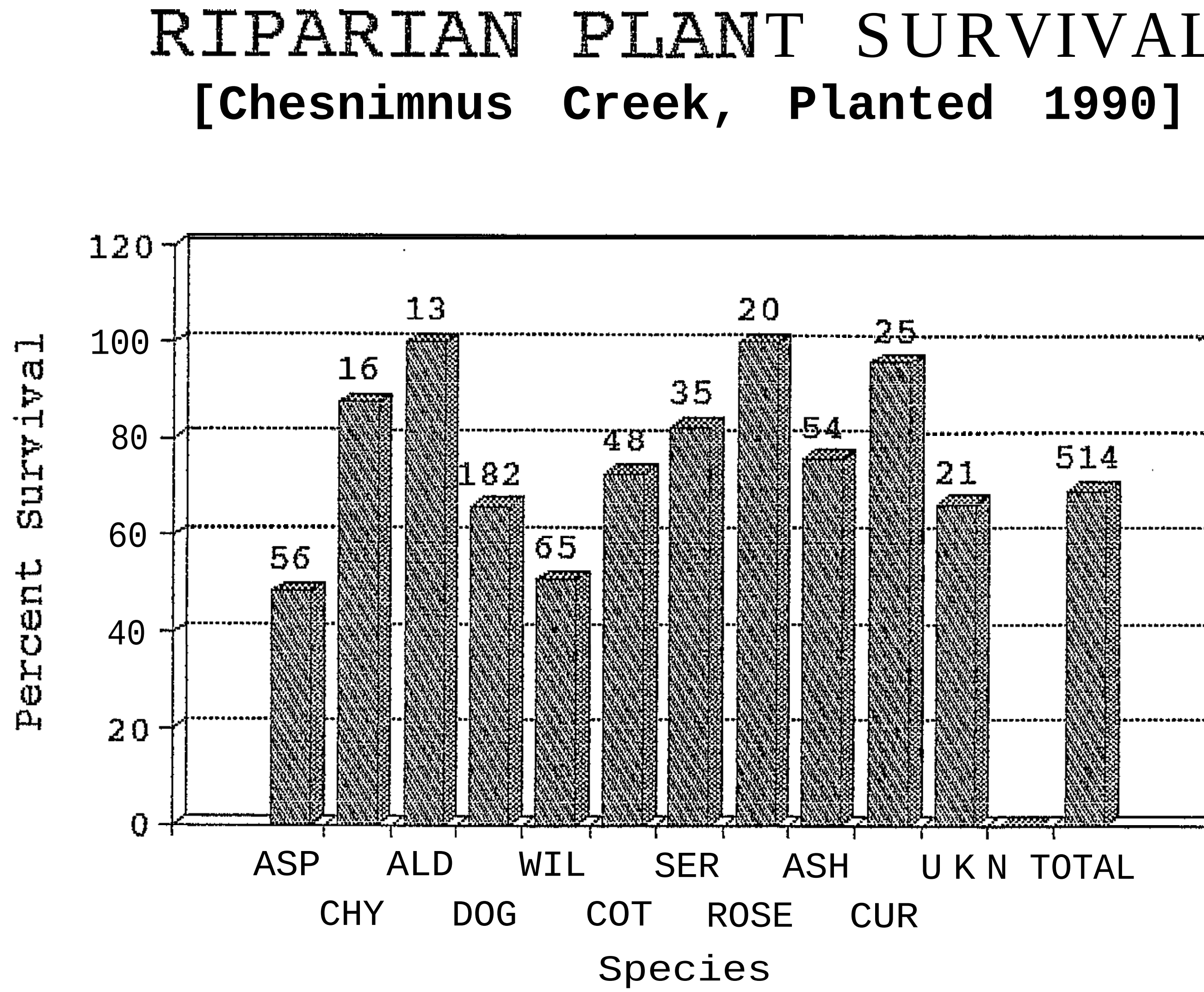


FIGURE 13. Survival of riparian plantings for Chesnimnus Creek after 1 year.

Species	Species Code
ASPEN	ASP
CHERRY	CHY
ALDER	ALD
DOGWOOD	DOG
WILLOW	WIL
COTTONWD	COT
SERVICE	SER
ROSE	ROSE
MT ASH	ASH
CURRANT	CUR
UNKNOWN	UKN

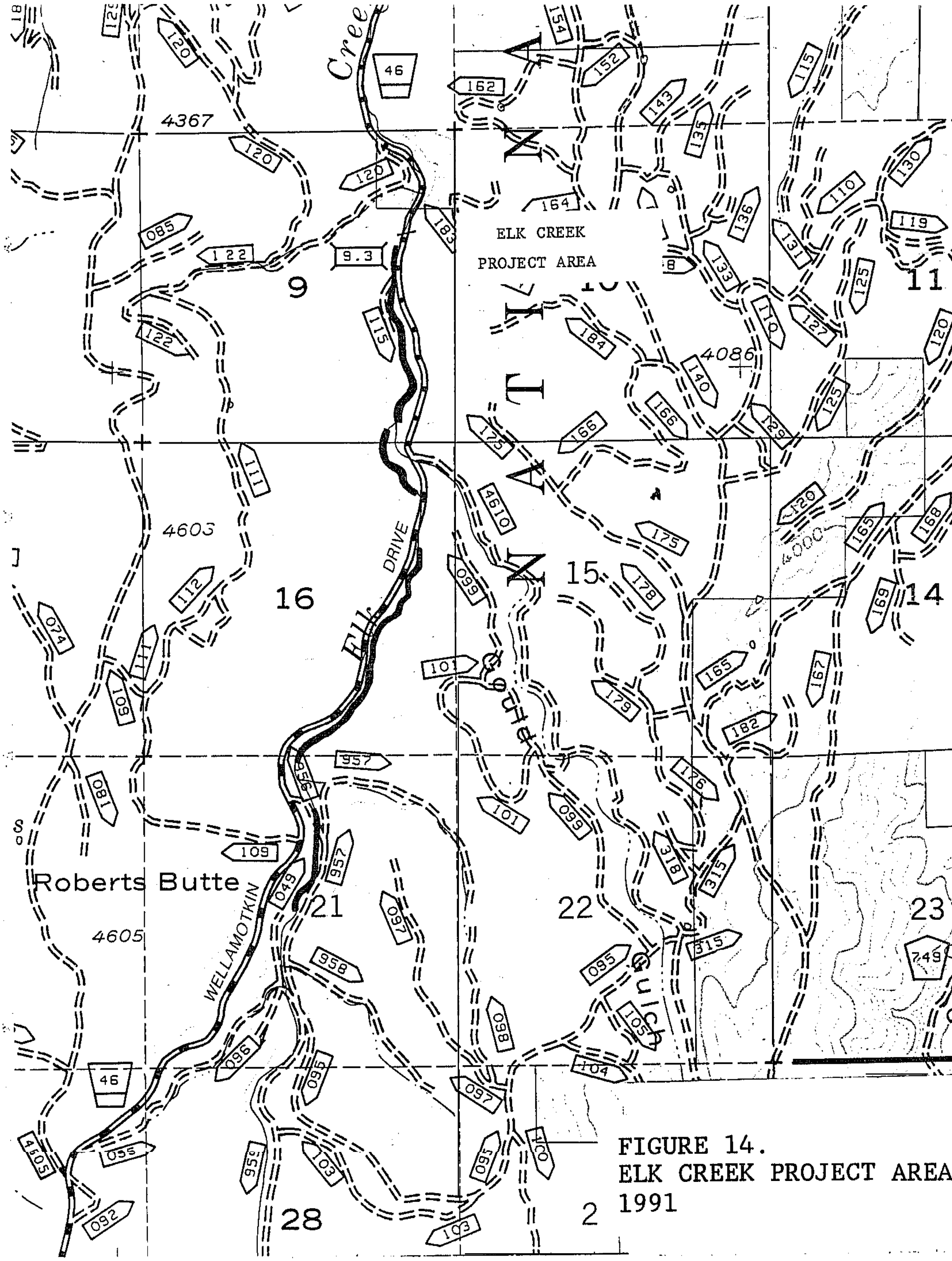


FIGURE 14.
ELK CREEK PROJECT AREA
1991

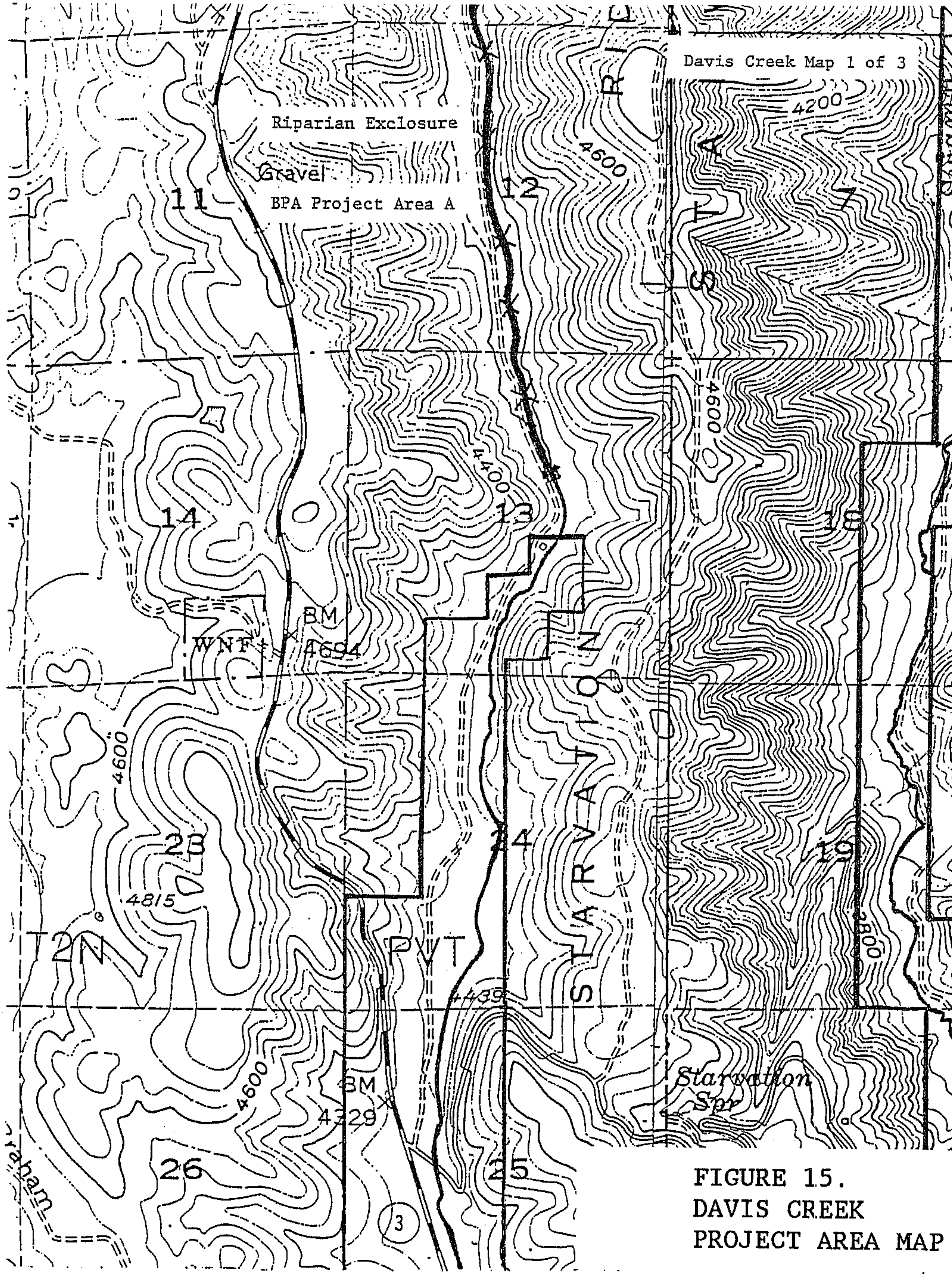
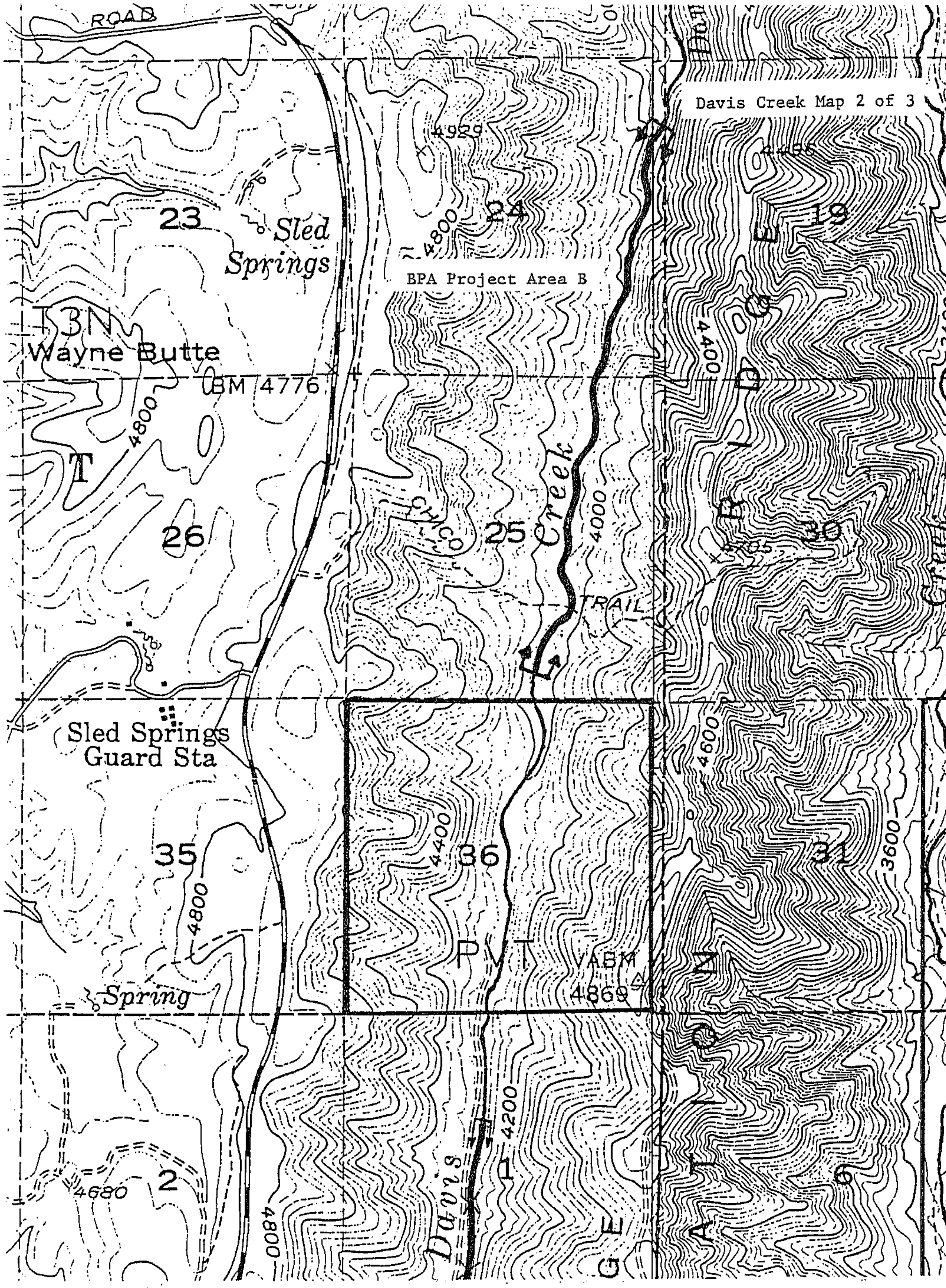
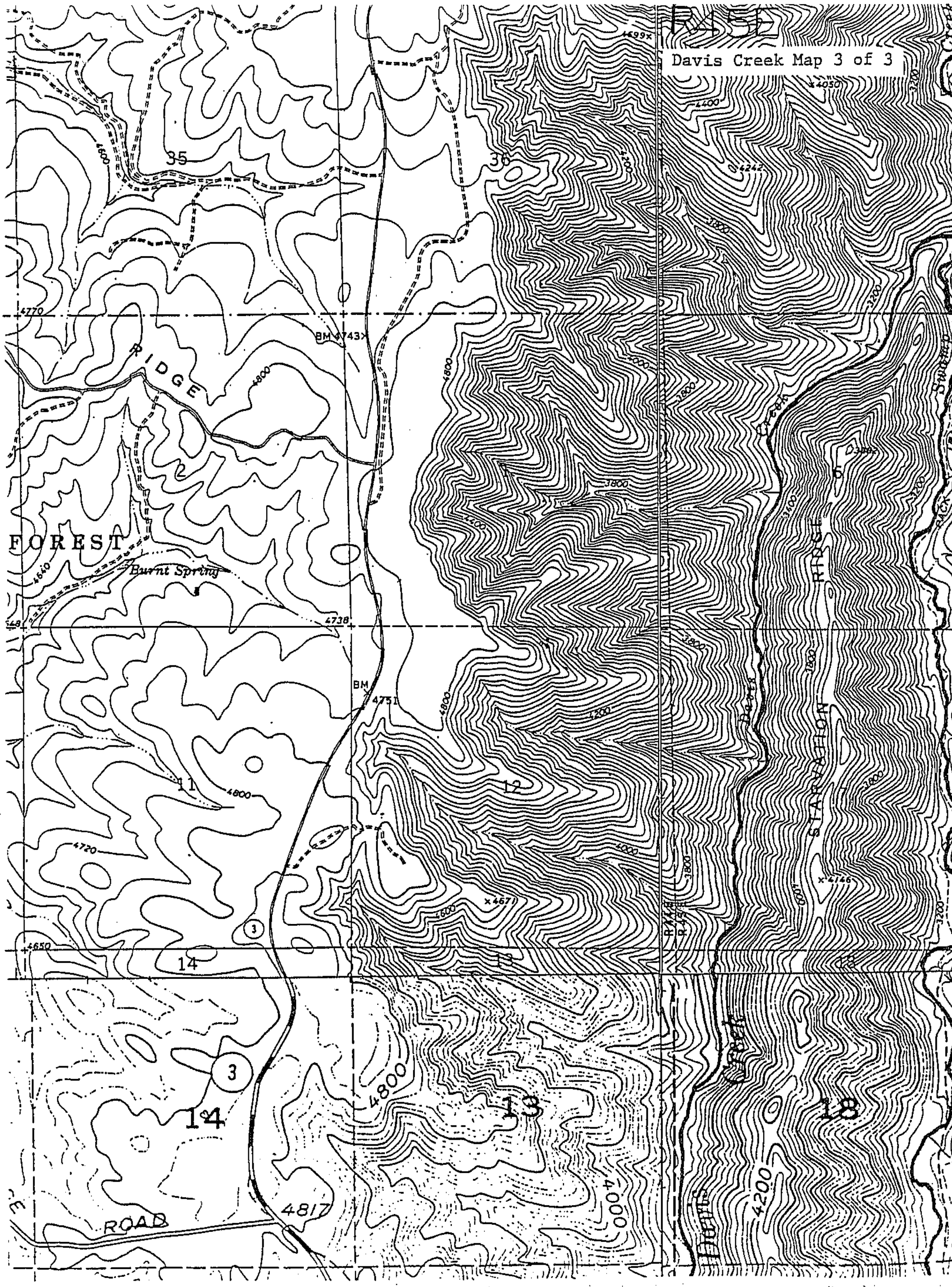


FIGURE 15.
DAVIS CREEK
PROJECT AREA MAP

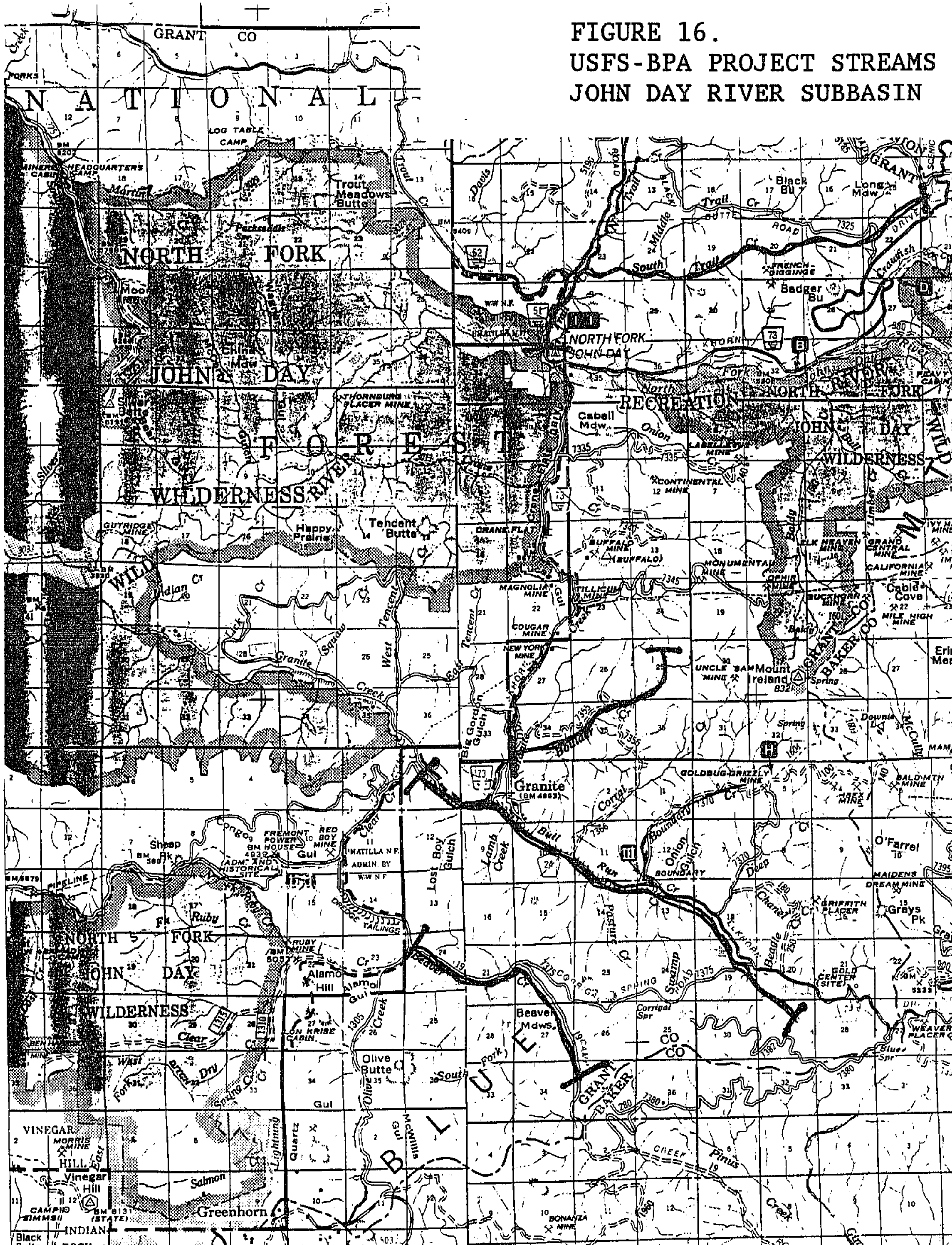


Davis Creek Map 2 of 3
ROAD
BPA Project Area B
4929
23
24
19
Sled Springs
T3N
Wayne Butte
BM 4776
4800
4400
4000
T
Chico
26
25
30
Creek
TRAIL
Sled Springs Guard Sta
4600
35
36
31
3600
PVT
VABM 4869
Spring
4200
Davis
2
1
6
4680

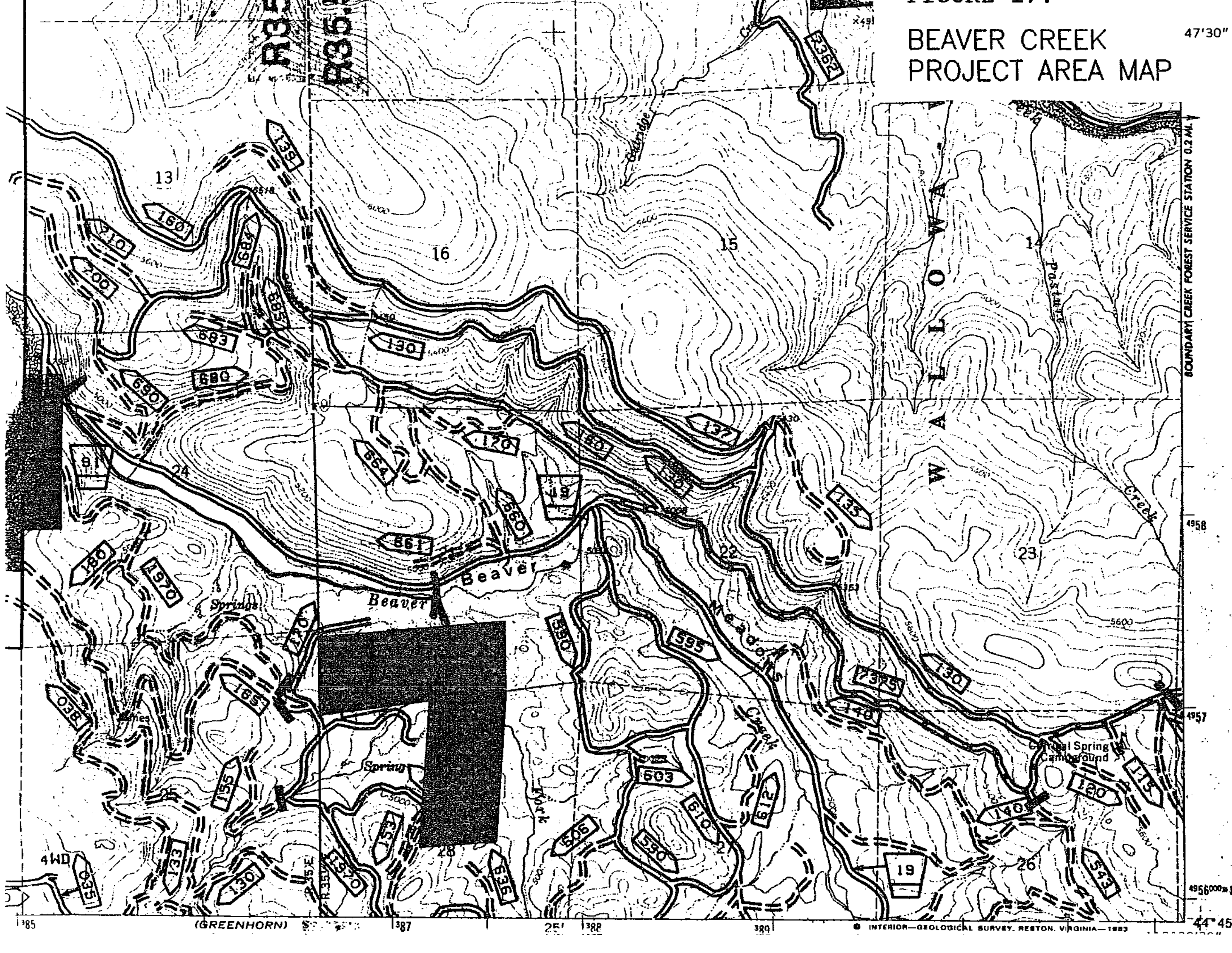


Davis Creek Map 3 of 3
35
36
RIDGE
BM 4743
FOREST
Burnt Spring
4738
BM
4751
11
4800
12
4720
STARVATION
RIDGE
14
13
18
4800
4817
ROAD
4000
4200

FIGURE 16.
USFS-BPA PROJECT STREAMS
JOHN DAY RIVER SUBBASIN



BEAVER CREEK
PROJECT AREA MAP



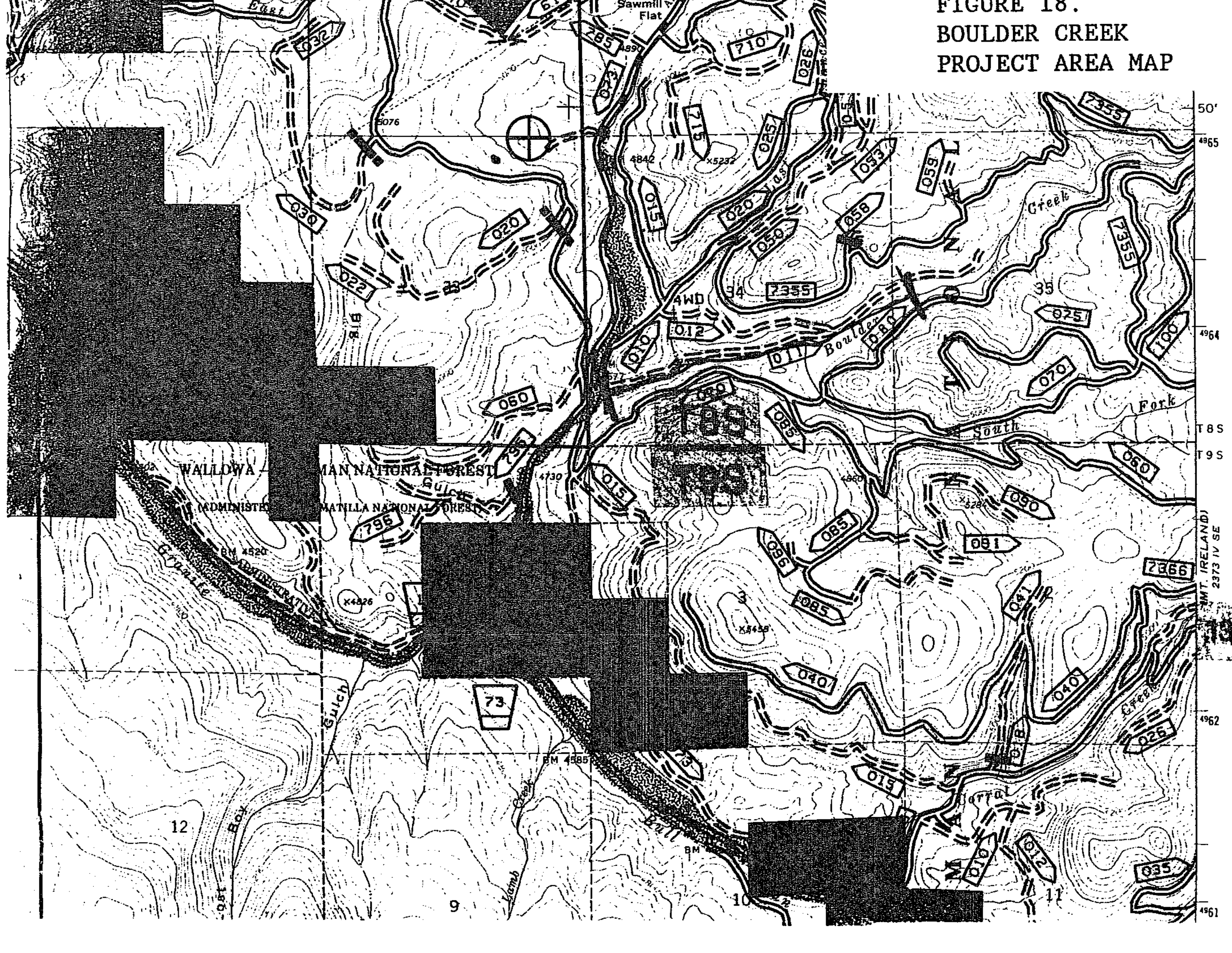


FIGURE 18.
BOULDER CREEK
PROJECT AREA MAP

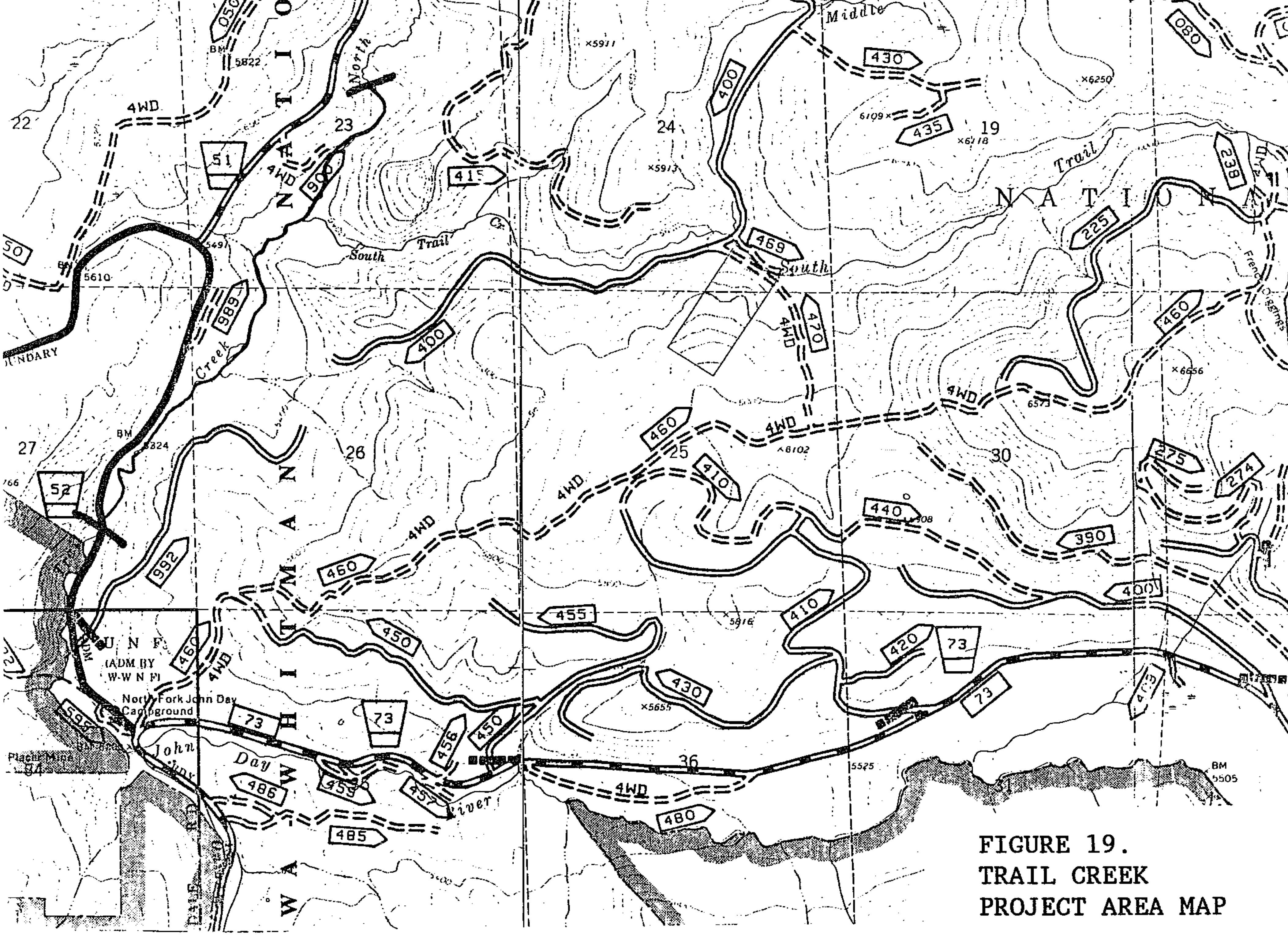


FIGURE 19.
TRAIL CREEK
PROJECT AREA MAP

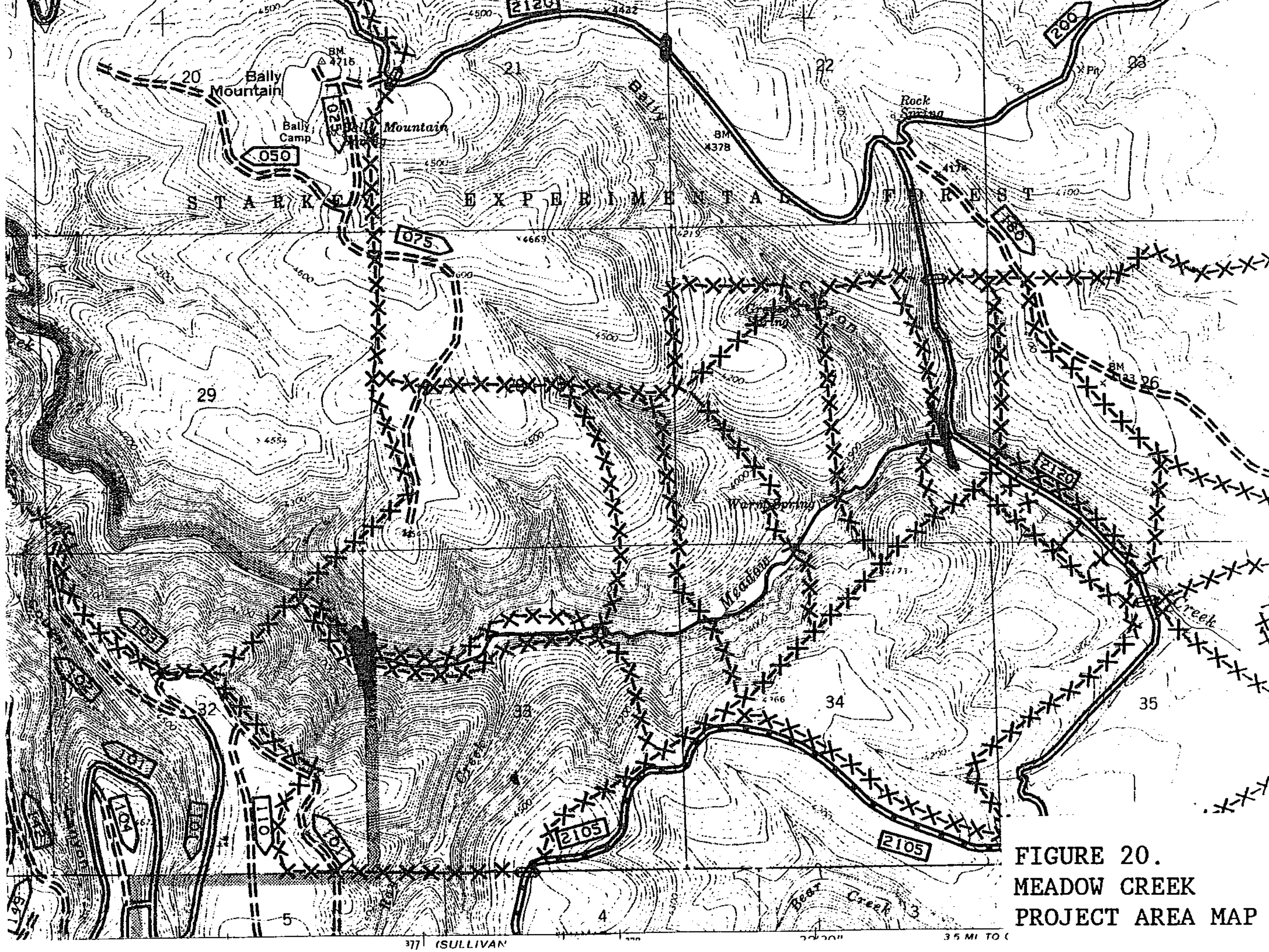


FIGURE 20.
MEADOW CREEK
PROJECT AREA MAP

FIGURE 21.

LAGRANDE RANGER DISTRICT
UPPER GRANDE RONDE SUB-BASIN
UISFS-BPA PROJECT STREAMS FY 91

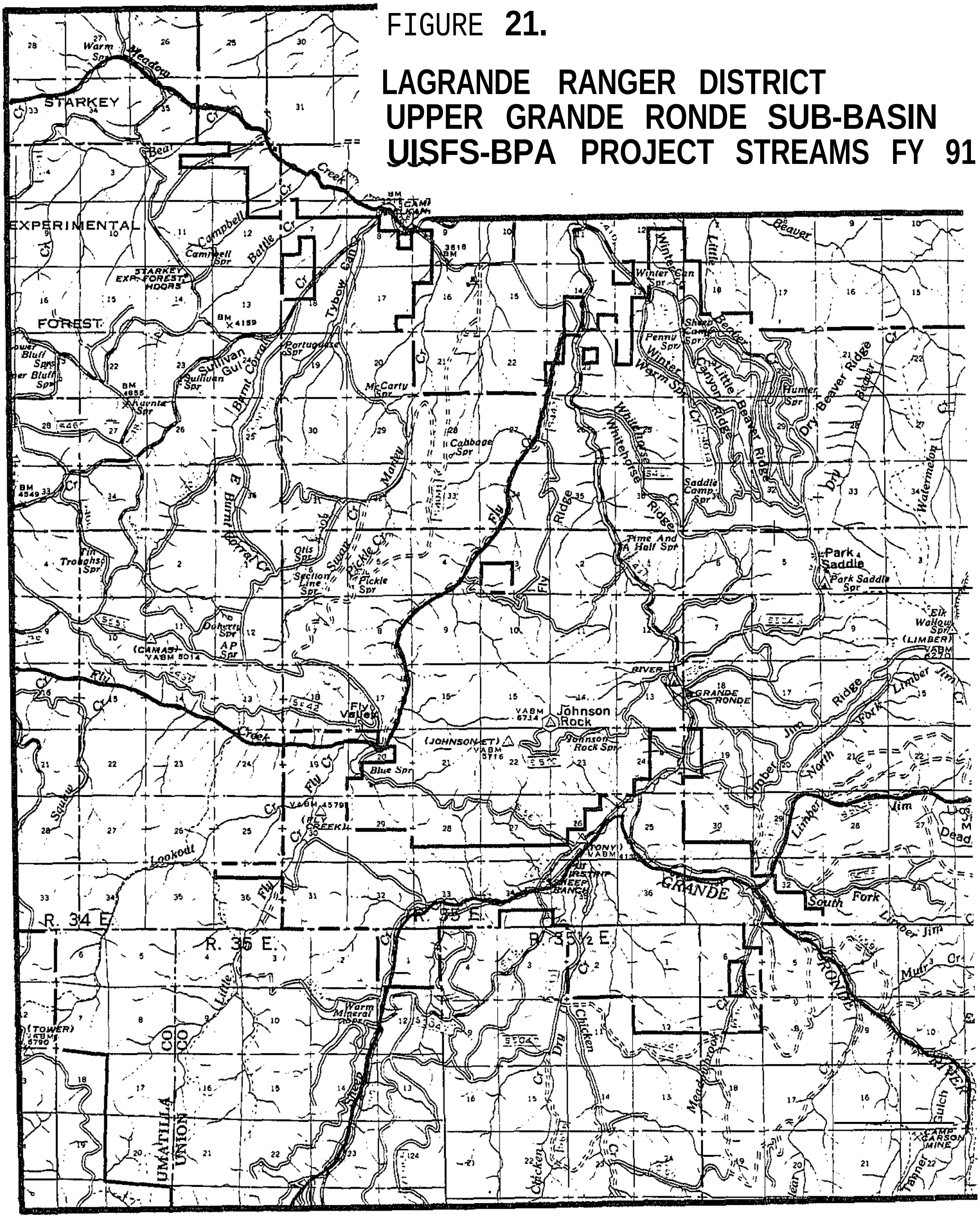


FIGURE 9

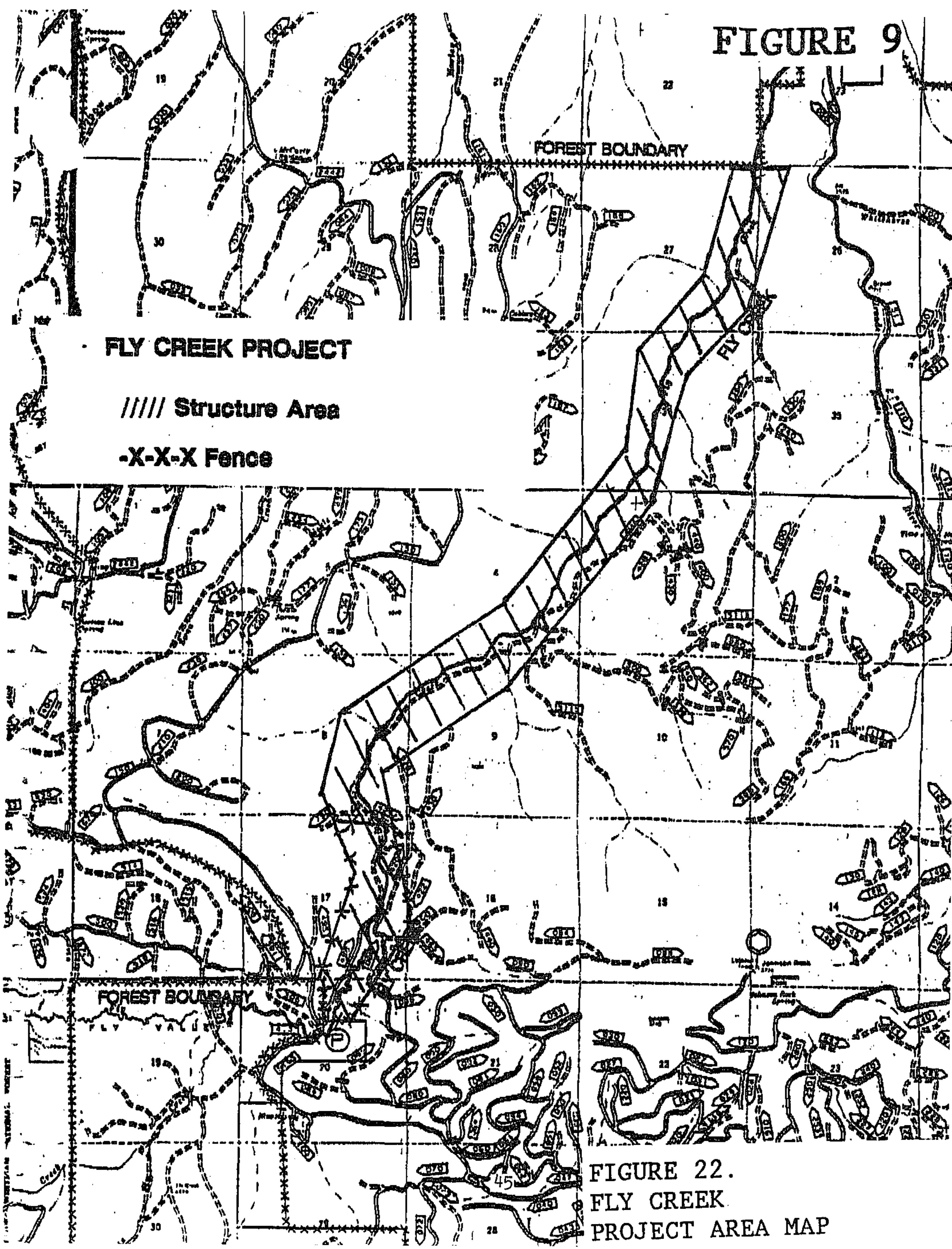


FIGURE 22.
FLY CREEK
PROJECT AREA MAP

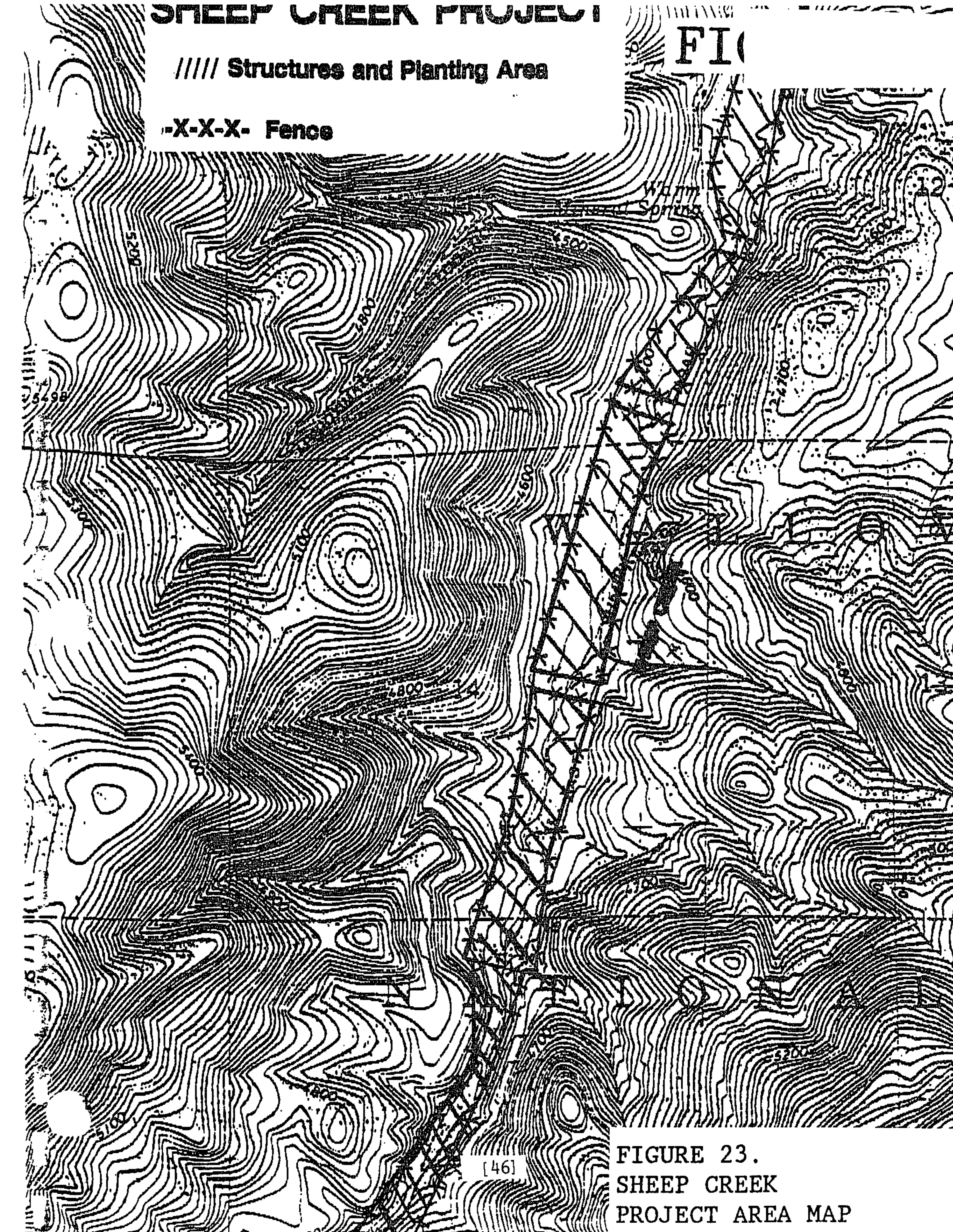


FIGURE 23.
SHEEP CREEK
PROJECT AREA MAP

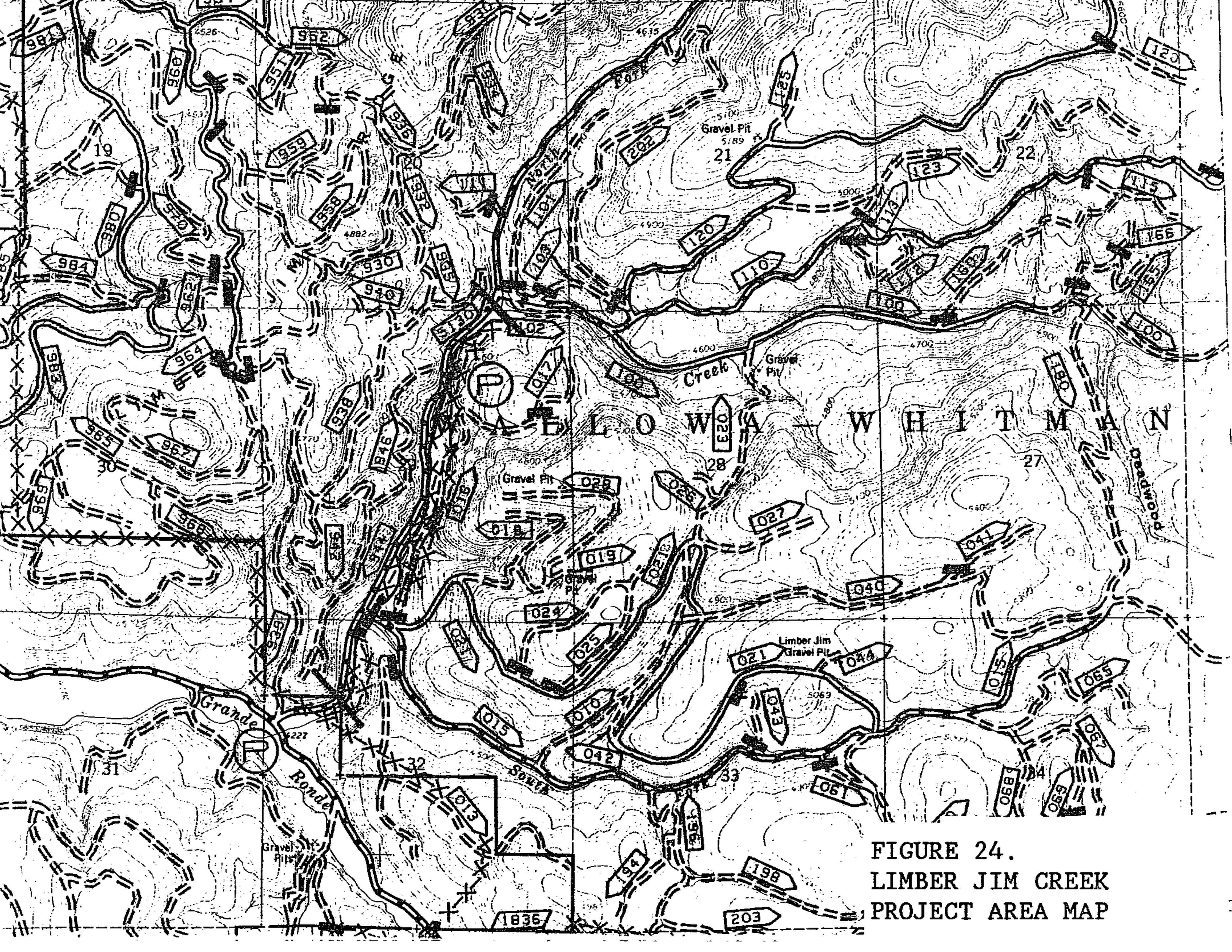


FIGURE 24.
LIMBER JIM CREEK
PROJECT AREA MAP

APPENDIX 2.

Appendix

KEY TO ABBREVIATIONS USED FOR IMPROVEMENT STRUCTURE TYPES

Joseph Creek Subbasin
Chesnimnus Creek Section G-H-I

Boulders

BP	Boulders placed
BPB	Bank protection boulders
TB	Turning boulders
BD	Boulder dam

Whole Trees

WT_{45}	Whole tree placed at 45° to channel
WT_{90}	Whole tree placed at 90° to channel
RW	Root wad
WTC	Whole tree cover
WTB	Whole tree bank protection

Logs

LS	Log sill
LS_{45}	Log sill placed at 45° to channel
L_{45}	Log across creek at 45°
L	Cover log
LWU	Log weir, upstream "vee"
LWO	Log weir, downstream "vee"
LBP	Log bank protection
LJ	Log jam
DL_{45}	Digger log placed at 45° to channel

APPENDIX 3.

EXPLANATION OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

CHESNIMNUS CREEK SECTION G-H-I

Structure Number	Description of Structure
1	6 whole trees placed at 90 degrees to channel, boulders placed
2	2 whole trees placed for cover
3	1 whole tree 90 degrees to channel, 2 whole trees bank protection
4	1 whole tree placed for cover
5	1 whole tree placed for cover
6	Artificial log jam
7	2 whole trees placed at 90 degrees to channel
8	Boulders placed for bank protection, 1 whole tree bank protection
9	2 whole trees placed for cover
10	1 whole tree placed for bank protection
11	1 whole tree cover, 1 whole tree bank protection
12	Log sill with 2 whole trees for cover
13	Log sill with 2 whole trees for cover
14	2 whole trees at 45' and 2 whole trees at 90'to channel
15	3 whole trees for bank protection, 1 whole tree cover
16	Artificial log jam, 4 whole trees placed for cover
17	Artificial log jam, 4 whole trees placed for cover
18	Log sill with 2 whole trees for cover
19	Artificial log jam, 3 whole trees for bank protection
20	1 log across channel, 1 log at 45 degrees to channel
21	2 whole trees at 45'. 2 whole trees placed at 90'to channel
22	8 whole trees, 4 cover and 4 bank protection
23	Log sill with 3 whole trees for cover
24	Artificial log jam, 8 whole trees, 2 at 45' 2 at 90, 2 cover
25	2 whole trees placed for bank protection, 2 root wads
26	Log sill
27	2 whole trees placed for bank protection, 2 boulders placed
28	Log placed in channel
29	Log sill with 1 whole tree placed for cover
30	2 whole trees placed for bank protection
31	1 whole tree placed for bank protection
32	Artificial log jam with whole tree placed for cover
33	Whole tree placed for bank protection
34	Boulder dam, whole tree placed for bank protection
35	2 whole trees placed for cover, 1 whole tree placed at 90'
36	Log placed for bank protection
37	2 whole trees at 90'. 1 whole tree at 45'to channel
38	2 whole trees placed for cover
39	Log sill with 2 whole trees placed for cover
40	Artificial log jam, 1 whole tree cover, 1 bank protection
41	1 whole tree placed for bank protection
42	Log sill with 1 whole tree placed for cover
43	Log sill with 1 whole tree placed for cover
44	1 whole tree placed at 45 degrees to channel

continued

Structure Number	Description of Structure
45	1 whole tree placed for bank protection
46	2 whole trees cover. 2 whole trees placed for bank protection
47	Artificial log jam
48	1 whole tree placed for bank protection
49	Artificial log jam
50	2 whole trees placed for bank protection
51	1 log and 1 whole tree placed for bank protection
52	Log sill
53	Artificial log jam with 3 whole trees placed for cover
54	3 whole trees placed for cover, 2 whole trees at 90'to channel
55	Artificial log jam
56	2 whole trees placed for cover
57	Log sill with whole tree placed for cover
58	Artificial log jam with whole tree placed for cover
59	Artificial log jam
60	2 whole trees placed for cover
61	Artificial log jam
62	1 whole tree placed for cover
63	1 digger log at 45'in channel, 5 whole trees placed for cover
64	1 whole tree placed for cover
65	Artificial log jam, with 5 whole trees placed for cover
66	1 whole tree placed for cover
67	Artificial log jam
68	1 whole tree placed at 45'in channel
69	5 whole trees placed for bank protection
70	1 whole tree placed for cover
71	Artificial log jam, whole tree placed for bank protection
72	4 whole tree placed for cover
73	Log sill
74	4 whole trees placed for cover, 1 root wad placed for habitat
75	Log sill, whole tree cover. whole tree bank protection
76	2 whole trees placed for cover habitat
77	4 whole trees placed for cover habitat
78	4 digger logs placed at alternating 45'angels in channel
79	1 whole tree placed at 90'in channel
80	1 whole tree cover. and 1 whole tree placed for bank protection
81	1 whole tree placed for cover habitat
82	Log sill with whole tree placed for cover
83	3 whole trees, 1 cover, 1 bank protection, 1 at 90'in channel
84	2 logs placed for bank protection
85	1 whole tree placed for cover habitat
86	Artificial log jam, with 1 whole tree placed for cover habitat
87	Artificial log jam, whole tree cover, log bank protection
88	1 whole tree cover habitat, 1 whole tree bank protection
89	Log sill. 2 whole trees placed for bank protection
90	Artificial log jam
91	Artificial log jam. 2 digger logs at alternating 45'in channel
92	2 whole trees placed for cover habitat
93	2 whole trees placed at opposing 45'in channel

continued

Structure Number	Description of Structure
94	2 whole trees placed for bank protection
95	Log sill, 2 whole trees placed for bank protection
96	Artificial log jam with whole tree placed for cover habitat
97	Artificial log jam. log placed at 45'in channel
98	Artificial log jam with whole tree placed for cover habitat
99	Artificial log jam, log placed at 45'in channel
100	Log sill with whole tree placed for cover habitat
101	1 whole tree cover habitat, 1 whole tree at 45'in channel
102	Artificial log jam with whole tree placed for cover habitat
103	Root wad placed for habitat
104	1 whole tree placed in channel at 45'
105	1 whole tree placed for cover habitat
106	1 whole tree cover habitat, 1 whole tree for bank protection
107	1 whole tree placed in channel at 45', 1 whole tree cover
108	1 whole tree placed in channel at 45'
109	6 whole trees, 2 cover. 2 bank protection, 2 at 45'in channel
110	1 whole tree cover, 2 whole trees in channel at 45'
111	2 whole trees at 90'to channel, 2 whole trees cover habitat
112	3 whole trees, 1 cover, 1 bank protection, 1 45'in channel
113	Artificial log jam
114	3 whole trees placed in channel for cover habitat
115	Artificial log jam
116	2 whole trees in channel at 90'. 1 whole tree cover habitat
117	2 whole trees in channel at opposing 45'. 1 whole tree cover
118	Log sill, whole tree bank protection, whole tree cover habitat
119	2 whole trees at 45'. 2 whole trees, 1 cover, 1 bank protection
120	1 whole tree at 45'in channel, 1 whole tree bank protection
121	1 whole tree at 90'in channel, 1 whole tree bank protection
122	3 whole trees, 1 cover. 1 bank protection, 1 at 45'in channel
123	Log sill, 3 whole trees, 1 cover, 1 bank protection, 1 at 45'
124	1 whole tree for cover habitat, 1 whole tree in channel at 45'
125	Log sill at 45'. 2 whole trees, 1 cover, 1 bank protection
126	3 whole trees, 1 cover, 1 bank protection, 1 at 90'to channel
127	Artificial log jam. with whole tree for cover habitat
128	log sill placed at 45'in channel, whole tree for cover habitat
129	1 whole tree placed in channel for cover habitat
130	Log sill with whole tree placed for cover habitat
131	Log sill
132	1 whole tree placed in channel at 90'
133	Log sill with 2 whole trees, 1 cover, 1 bank protection
134	1 whole tree placed in channel for cover habitat
135	2 whole trees at 45', 3 whole trees placed for bank protection
136	Log sill with whole tree cover habitat
137	2 whole trees placed for cover habitat
138	4 whole trees placed for bank protection
139	2 whole trees placed at 45'in channel. whole tree cover habitat
140	Artificial log-jam
141	Log sill, 2 whole tree cover, 2 whole tree at 45'in channel
142	Whole tree placed at 90'in channel. 2 whole tree cover habitat

continued

Structure Number	Description of Structure
143	2 whole trees at 45'in channel, whole tree cover habitat
144	Log sill with whole tree placed at 45'in channel
145	Artificial log jam. with whole tree cover habitat
146	Artificial log jam, with whole tree cover habitat
147	4 whole trees placed for bank protection and habitat
148	1 whole tree cover habitat and 1 whole tree cover habitat
149	2 whole tree cover habitat, 1 whole tree at 45'in channel
150	Log sill, whole tree bank protection, log anchored in channel
151	6 whole trees, 1 cover, 1 at 45', 4 bank protection
152	4 whole trees for cover habitat, boulders placed
153	2 whole trees cover habitat, 2 whole trees for bank protection
154	Log sill, 2 whole trees, 1 cover, 1 bank protection
155	Artificial log jam. 3 whole trees, cover, bank protection, 90'
156	Log sill with 3 whole trees placed for cover habitat
157	4 digger logs at opposing 45 angles, 2 whole trees for cover
158	2 whole trees at opposite 45'angles in channel
159	Artificial log jam. 1 whole tree for bank protection
160	1 whole tree placed for cover habitat
161	1 whole tree at placed at 45'in channel, 1 whole tree cover
162	Log sill with whole tree placed for cover habitat
163	Artificial log jam, whole tree placed for bank protection
164	4 logs placed in channel at opposing 45'angels
165	1 whole tree placed for bank protection
166	2 whole trees placed for bank protection, 1 whole tree cover
167	2 whole trees at 45'in channel, 2 whole trees bank protection
168	2 whole trees at 45'in channel, 2 whole trees cover habitat
169	2 whole trees placed in channel for cover habitat
170	Log sill, 4 whole trees, 2 cover. 2 at 90'in channel
171	2 whole trees placed for cover habitat
172	Log sill, 1 whole tree cover. 1 whole tree at 45'in channel
173	1 whole tree placed for cover habitat
174	Log sill
175	Artificial log jam
176	Artificial log jam, whole tree bank protection, whole tree 45'
177	3 whole trees cover habitat, 1 whole tree at 90'in channel
178	1 whole tree cover. 1 whole tree at 45'in channel
179	'7 whole trees placed for bank protection
180	1 whole tree cover habitat, 1 whole tree at 90'in channel
181	2 whole trees placed for bank protection
182	Log sill, with 2 whole trees placed for cover habitat
183	3 whole trees placed for bank protection
184	2 whole trees placed at 45 angles in channel
185	2 whole trees at 45' 2 whole trees placed for bank protection

<u>Appendix</u>

APPENDIX 4.

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

CHESNIMNUS CREEK SECTION G-H-I

Structure Type

Structure Number	BP	BPB	TB	BD	WT$_{45}$	WT$_{90}$	WTC	WTB	LS	LS$_{45}$	L	'45	WU	WD	BP	LJ	DL$_{45}$	RW
1	X		X			X												
2							X											
3						X		X										
4							X											
5							X											
6																X		
7						X												
8		X						X										
9							X											
10								X										
11							X	X										
12							X		X									
13							X		X									
14					X	X												
15							X	X										
16							X									X		
17							X									X		
18							X		X									
19								X								X		
20											X	X						
21					X	X												
22							X	X										
23							X		X									
24					X	X	X									X		
25								X										X
26									X									
27	X							X										
28											X							
29							X		X									
30								X										
31								X										
32							X									X		
33								X										
34				X				X										
35						X	X											
36															X			
37					X	X												

continued

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

CHESNIMNUS CREEK SECTION G-H-I (continued)

	Structure Type																	
Structure Number	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
38							X											
39							X		X									
40						X	X									X		
41								X										
42							X		X									
43							X		X									
44					X													
45								X										
46							X	X										
47																X		
48								X										
49																X		
50								X										
51								X							X			
52									X									
53							X									X		
54						X	X											
55																X		
56							X											
57							X		X									
58							X									X		
59																X		
60							X											
61																X		
62							X											
63						X											X	
64							X											
65							X									X		
66							X											
67																X		
68					X													
69								X										
70							X											
71								X								X		
72							X											
73									X									
74							X											X

continued

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

CHESNIMNUS CREEK SECTION G-H-I (continued)

	Structure Type																	
Structure Number	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	BP	LJ	DL_{45}	RW
75							X	X	X									
76							X											
77							X											
78																	X	
79						X												
80							X	X										
81							X											
82							X		X									
83						X	X	X										
84															X			
85							X											
86							X									X		
87							X								X	X		
88							X	X										
89								X	X									
90																X		
91																X	X	
92							X											
93					X													
94								X										
95								X	X									
96																X		
97							X			X						X		
98							X									X		
99																X		
100							X		X									
101					X		X											
102							X									X		
103																		X
104					X													
105							X											
106							X	X										
107					X		X											
108					X													
109					X		X	X										
110					X		X											
111						X	X											

continued

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

CHESNIMNUS CREEK SECTION G-H-I (continued)

	Structure Type																	
Structure Number	BP	BPB	TB	BD	VT$_{45}$	VT$_{90}$	VTC	VTB	LS	LS$_{45}$	L	L$_{45}$	LWU	LWD	LBP	LJ	DL$_{45}$	RW
112					X		X	X										
113																X		
114							X											
115																X		
116						X	X											
117					X		X											
118							X	X		X								
119					X		X	X										
120					X			X										
121						X		X										
122					X		X	X										
123					X		X	X								X		
124					X		X											
125							X	X		X								
126						X	X	X										
127							X									X		
128							X			X								
129							X											
130							X		X									
131									X									
132						X												
133							X	X	X									
134							X											
135					X			X										
136							X		X									
137							X											
138								X										
139					X		X											
140																X		
141					X		X		X									
142						X	X											
143					X		X											
144					X				X									
145							X									X		
146							X									X		
147								X										
148							X	X										

continued

SUMMARY OF IMPROVEMENT STRUCTURES BY PROJECT CREEK

CHESNIMNUS CREEK SECTION G-H-I (continued)

Structure Number	Structure Type																	
	BP	BPB	TB	BD	VT_{45}	VT_{90}	JTC	VTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW
149					X		X											
150							X		X		X							
151					X		X	X										
152	X						X											
153							X	X										
154							X	X	X									
155						X	X	X								X		
156							X		X									
157							X										X	
158					X													
159								X								X		
160							X											
161					X		X											
162							X		X									
163								X								X		
164												X						
165								X										
166							X	X										
167					X			X										
168					X		X											
169							X											
170						X	X		X									
171							X											
172					X		X		X									
173							X		X									
174									X									
175																X		
176					X			X								X		
177						X	X											
178					X		X											
179								X										
180						X	X											
181								X										
182							X		X									
183								X										
184					X													
185					X			X										

CHESNIMNUS CREEK SECTION G-H-I Total by Type

	Structure Type																	
	BP	BPB	TB	BD	WT_{45}	WT_{90}	WTC	WTB	LS	LS_{45}	L	L_{45}	LWU	LWD	LBP	LJ	DL_{45}	RW	
TOTALS	3	1	1	1	36	23	108	58	32	4	3	2	0	0	4	38	4	3	= 321